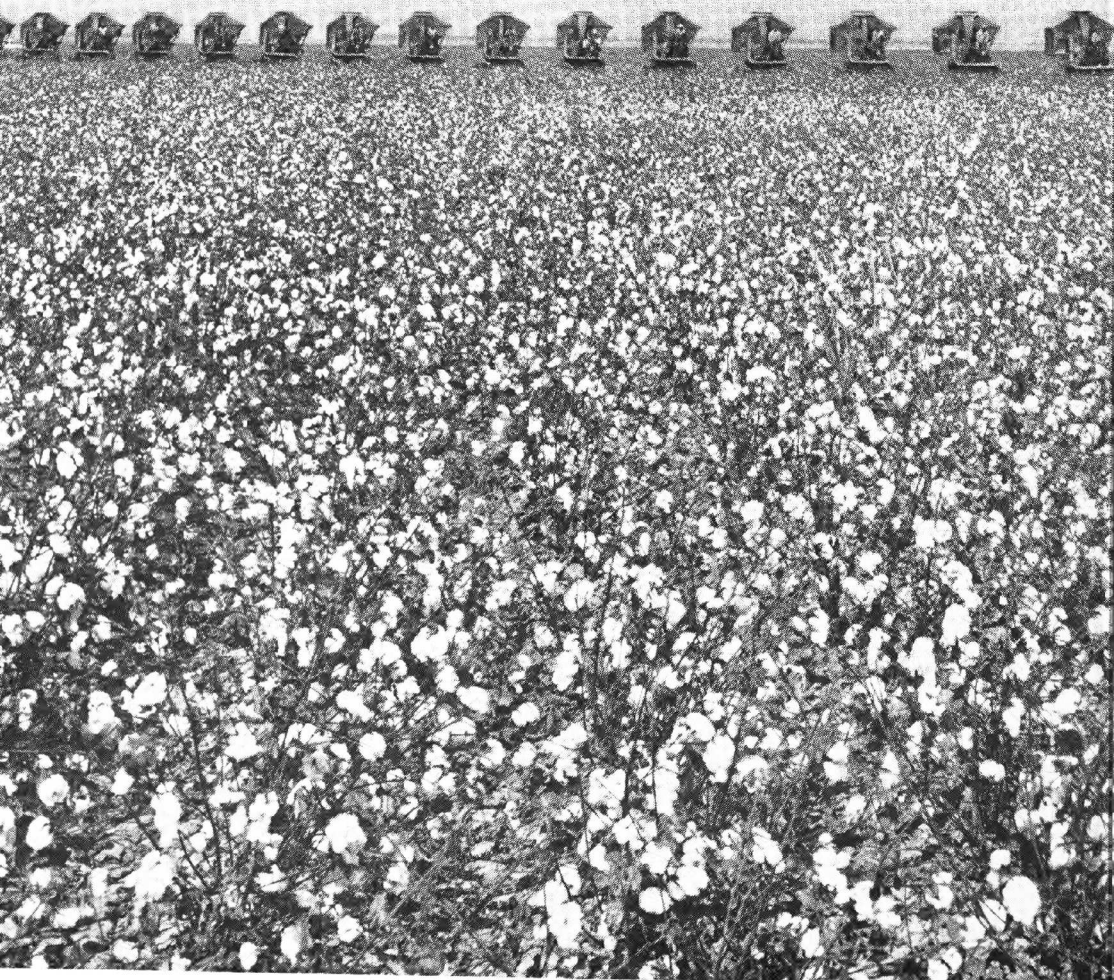


**THE NEW REVOLUTION
IN THE COTTON ECONOMY**



NATIONAL COTTON COUNCIL OF AMERICA

Cotton picking machines at work in one field in the
Tulare Lake Basin of California.

By JAMES H. STREET

THE
New Revolution
IN THE
Cotton Economy

MECHANIZATION AND ITS CONSEQUENCES

CHAPEL HILL

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PREFACE

OVER THE YEARS during the past century many enthusiastic writers have heralded a "revolution in cotton" on seeing some new machine that gave promise of replacing the drudgery of hand labor in gathering the crop. Many such machines have been tried, often with great fanfare, but generally with abortive results.

Five years ago, when I began the present study, there was still some question in my mind whether the term "revolution," in the sense of a rapid and widespread change, could fairly be applied to the American cotton economy. Such a revolution had once occurred in the early history of the enterprise. While the study was in progress it became unquestionably clear that a new revolution is under way.

Where there were only experimental models a few years ago, there are now over 18,000 mechanical cotton harvesters of the spindle type and 23,000 mechanical cotton strippers in use in the cotton region today. In the 1955 crop season nearly three and a half million bales of cotton were mechanically harvested, representing almost one-fourth of the American crop. In California, the leading state, machines harvested two-thirds of the crop.

This is not the evidence, but rather the symbol, of the change. Equally significant is the fact that in the western portions of the region virtually all other stages of production of the crop have been brought under mechanical control. The feasibility of completely mechanizing

the crop—so long in doubt—has thus been established in important localities. This has become possible only by virtue of a remarkable concurrence of individually significant achievements in plant breeding, weed control, plant defoliation, and cotton ginning, as well as in the perfection of efficient mechanical harvesting devices in themselves. All of these developments have come about in very recent years, and their full effects are therefore yet to be felt.

There is no longer any reason to doubt that there will be profound changes in the cotton economy in the prospective future. Cotton production is at last becoming a technically efficient enterprise. Productivity per man hour and per planted acre are rising; hence economic returns to farm operators and farm workers can be expected to rise, too. Traditional tenure systems and patterns of farm organization are changing. Children are being released from the cotton fields to attend school. These and many other changes constitute the new revolution in the cotton economy. As an enterprise cotton still has problems to face, but even the problems are undergoing radical change.

In this study I have sought answers to two questions: Why has a rapid acceleration recently begun in the improvement of American methods of cotton production? And why did it take so long? Chronologically, and analytically, the questions come in the reverse order. Stated more fully and precisely, the first question raised is: In the light of the early history of vigorous growth of the cotton enterprise and in light of the history of mechanization of other major crops, why was technological advance in American cotton production so long delayed?

It is my belief that to explain the delay is fully as important as to explain the change. To a large extent the problems of the world today are problems arising out of disparate rates of change—social and economic, institutional and technological. This is the urgency which attaches to the formulation and elaboration of a satisfactory general explanation of economic development. The present study, limited though it is, is intended as a contribution to such an explanation. In this respect it differs from other recent studies of cotton mechanization which concentrate chiefly on the more narrowly economic (but nonetheless significant) aspects of technical change. The emphasis on the entire process of economic development, rather than merely on its more recent and dramatic phases, therefore accounts for the fact

that the process of mechanization itself is not discussed until Part 2 of this book. To some extent this reflects the chronology of developments, but also it reflects an attempt to treat mechanization in its total setting of customary farming arrangements, political policies, influential outside forces, and social consequences.

The study relies for its basic conceptions primarily upon two sources: the respective analyses of economic development of C. E. Ayres and Simon S. Kuznets. Professor Ayres' penetrating description of the institutional and technological aspects of economic change is brilliantly set forth in *The Theory of Economic Progress*.¹ Professor Kuznets' perceptive classroom treatment of the process of economic development has unfortunately not appeared in print, but his factorial method of analysis is exemplified in an early essay on "Retardation of Industrial Growth."²

An attempt to fuse the analytical approaches of two such vigorously independent minds is bound to have its hazards. I have assumed the risk in the hope that others may find the methods and certain of the conclusions of this study suggestive in investigating similar cases of arrested economic development in other parts of the world.

The decision to deal with the process of cotton mechanization in its total setting raised a perplexing question regarding the geographic area to be included. The question is in part conceptual and in part concerned with the availability of relevant data. The South or Southeast, considered as a cultural region in which most of the acute social problems associated with cotton growing are concentrated, is not coextensive with the Cotton Belt, the climatic region within which cotton is grown. As one moves west cotton loses its regional significance as a primary source of employment and income, but increases in significance as a crop in rapid process of mechanization. The institutional setting of western irrigated cotton, as well as the physical conditions of farming, are so different from those in the rain belt that little can be said about the process of change in one area that will be closely applicable to the other. What, therefore, is the "cotton economy"? Conceptually this study recognizes that the areas in which cotton is

1. C. E. Ayres, *The Theory of Economic Progress* (Chapel Hill: The University of North Carolina Press, 1944).

2. *Journal of Economic and Business History*, I, No. 4 (August, 1929), 534-60. Reprinted in *Economic Change: Selected Essays in Business Cycles, National Income, and Economic Growth* (New York: W. W. Norton and Company, 1953), 253-77.

grown in the United States are heterogeneous both in social institutions and in physical geography, and the exposition seeks to make plain at all points which are the specific localities alluded to. Nevertheless, the assumption is made that all of the areas which produce cotton are closely interrelated by internal competition and by the governmental tendency to impose a uniform public policy on the crop, rather than on the people. What happens in one part of the Cotton Belt is likely to concern the other parts. In this sense it is an economy.

The other aspect of the question concerning the geographic scope of the study has been more troublesome though merely technical. One of the advantages of selecting the American cotton economy for a case study in economic development is that the empirical information available is so rich. Yet it is rarely available in geographic breakdowns that are strictly relevant to the purpose at hand—for reasons that are readily understandable. Political subdivisions, on the basis of which data are collected, only infrequently correspond to culturally and economically homogeneous areas. Moreover, the numerous valuable studies previously made of the various aspects of economic development which come into this investigation usually lack geographic comparability. For example, the Bureau of the Census has for many years organized its compilations according to the conventional geographic groupings which place sixteen states in what this study refers to as the "Census South." Even though this grouping includes Delaware, Maryland, West Virginia, Virginia, Kentucky, and Florida, which are unimportant as cotton states, population statistics and related data are usually summarized for this region and its divisions in order to compare them with similarly grouped information from other sources where state breakdowns are not available. The recent investigations by Calvin B. Hoover and B. U. Ratchford have designated the "South" as thirteen states—the sixteen in the Census grouping minus Delaware, Maryland, and West Virginia. Rupert B. Vance, in his highly useful population study, drops two additional states, Oklahoma and Texas, in accordance with Howard W. Odum's delineation of the "Southeast." This study draws freely, and gratefully, upon these and other studies for whatever light they may shed, even though comparability is lacking. The geographic designations used are those of the sources, and it is hoped that the reader will not be unduly confused.

It is perhaps needless to add that in treating the South as an economically underdeveloped area, although an assessment must be made

of the significance for economic development of particular institutions and policies, the aim is not to engage in social criticism. Rather, the study is an effort to understand and interpret in terms which may have general significance the differential rates of change to be observed in the historical process at work.

My interest in the subject of this book was first aroused during the depression years, when as a student at the University of Texas I was presented with Professor C. A. Wiley's acute insights into the problems of southern agriculture. I was also deeply stimulated by the ideas of Professor C. E. Ayres, whose originality of mind and unstinted personal encouragement have long been sources of inspiration, and for which there is no way of conveying adequate appreciation.

I am also grateful to Mrs. Wanneta Chance, Ray Newton, and others on the staff of the American Friends Service Committee who through the work camp program made it possible for me to spend two summers observing community experiments in the Mississippi Delta and in north central Mexico. In the course of these experiments I came to appreciate the devoted efforts of such people as Sam Franklin, Dr. Arthur W. Raper, Eugene and Lindsey Cox, John and Mack Rust, Arle Brooks, Art Landis, Wilmer and Mary Young, and David S. Richie, who poured their energies into attempts to alleviate some of the overwhelming problems which then confronted many farm families.

Later, during my service with the Division of Program Surveys of the Bureau of Agricultural Economics, I had the opportunity to travel widely in the Cotton Belt and to study its problems at close range. I particularly profited from instructive association with other members of the field staff, who included William McPeak, Clyde Robinson, Ben L. Owens, and Valter Monroe, as well as from the resourceful leadership of my superiors, Waldemar Nielsen, Dr. Bela Gold, Dr. Rensis Likert, and Dr. Howard R. Tolley.

In the course of the formal research for this book I incurred a special debt to Professor Simon S. Kuznets of the University of Pennsylvania, whose tireless curiosity and high standards of professional competence posed a constant challenge, and whose patient support at a critical period heartened my efforts. My regard for the frequently unappreciated services of government research workers was increased by generous assistance from Dr. Charles R. Sayre, Dr. E. L. Langsford, Dr. Margaret J. Hagood, Dr. Barbara B. Reagan, Dr. Warren R.

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Articles on theoretical aspects of this study have appeared in the *Journal of Farm Economics* and the *American Economic Review*. I wish to thank the editors of these publications for their kind permission to reprint.

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My wife, Mabel Carroll Street, has endured the drudgery of numerous revisions with unfailing good humor, and her editorial judgment is reflected throughout the narrative. Hers is the sort of collaboration for which there are no adequate words of recognition or gratitude.

J. H. S.

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PART 1

WHY COTTON FELL BEHIND

CHAPTER 1

The Early Revolution in Cotton

THE INTRODUCTION of cotton growing as a major farming enterprise during the early history of the United States took place under conditions unusually conducive to rapid growth and technological improvement within the industry. Events in the raw materials producing New World during this period were closely linked to the Industrial Revolution abroad, and for a time partook of the same innovating spirit. That this development should have exhausted its major potentialities, other than geographic expansion, within a relatively short time, and that cotton production ultimately fell markedly behind other major farm enterprises in both technology and institutional organization, is one of the curious and noteworthy aspects of American economic development. Moreover, because the cotton enterprise became economically so important to the region in which it developed, the peculiar stagnation in productive methods which characterized it after the early period of vigorous innovation seriously affected the institutional pattern of the southern culture as a whole.

The current revolution in methods of cotton production can be construed as a belated attempt to catch up with similar movements that occurred earlier in other parts of American agriculture as well as in manufacturing industry. Why was the new revolution so long in coming? The lag in economic progress in the cotton growing areas is the more remarkable when one considers that the region has shared

with the rest of the country a common language, a common culture, common political institutions, and, increasingly with the years, a considerable interchange of population. The introduction of labor-saving devices and the repeated reorganization of industry for greater efficiency have become a familiar American pattern. Yet the cotton region has only recently begun to renew its participation in this process.

THE IMPORTANCE OF LONG-TERM FACTORS

How are the disparate rates of change in productive methods to be explained? How are they affected by the system of social arrangements within which they take place? These questions cannot be answered without considering the long-term forces at work. The historical review which follows will deal selectively with the significant factors that shaped southern agriculture and that for a time gave cotton production the character of a declining enterprise. It will pay particular attention to the evolution and persistence of the set of dominant institutions within which the technical and economic organization of the enterprise took place.

A distinguishing attribute of social institutions is their resistance to change.¹ "The old ways are the best ways." However, customs and systems of control do change. When these changes occur, as in the case of the institutional reorganization of the South after the Civil War, it is important to note whether the changes are changes in function, or whether they are merely changes in form. This chapter will describe the early revolution in cotton and the forces which soon arrested it. Even today, in parts of the region, these forces have by no means disappeared.

THE EARLY EXPANSION OF COTTON PRODUCTION IN AMERICA

Most of the important American farm crops have a rather extended history of production under conditions of diversified agriculture and self-sufficient farming, from which they have gradually emerged to fill the increasing needs of an urban market. Cotton, however, notwith-

1. For a clear exposition of this point of view see C. E. Ayres, *The Theory of Economic Progress* (Chapel Hill: The University of North Carolina Press, 1944), especially chap. IX.

standing the fact that it had been grown in small quantities for domestic use from early colonial times, came into its own as a major crop almost overnight shortly after the Revolutionary War. One of the reasons this explosive occurrence was possible was that it took place within an established institutional framework already geared to commercialized specialization and exchange.

The initial expansion began in 1786 with the introduction of sea-island cotton into Georgia from the West Indies. This was a long-staple, smooth-seeded variety, which was not only superior in fiber quality to the indigenous varieties but much more easily removed from the seed with the simple hand mills of Asiatic design which were then in common use.²

The new crop found waiting for it a plantation economy with established overseas trade connections which was ready to exploit a new commercial opportunity. Tobacco, the principal commercial crop under the colonial regime, had gone into decline as a result of gradual and unrelieved exhaustion of the soil. Indigo and rice, which had also been highly profitable colonial crops, suffered severely from the dislocations of the Revolutionary War, not the least of which was the temporary loss of the English market. The introduction of a commercially practicable variety of cotton into the former colonies was therefore eagerly seized upon and expanded rapidly as a substitute crop. However, by about 1792 the expansion had virtually filled the geographic limits within which it was feasible to grow sea-island cotton, an area confined principally to the coastal plains of South Carolina and Georgia. Eventually, sea-island cotton found itself reduced to the relative status of a minor crop, becoming overshadowed by the technical achievements which gave impetus to the widespread expansion in the growth of upland cotton.

It was primarily the coincidence of the American invention of the cotton gin in 1793 with the insatiable raw material demand of the burgeoning British textile industry that enabled southern planters to continue the expansion of cotton growing and thus to maintain for many years a pre-eminent position in the commercialized sector of

2. For the information on which the following account is based, I am chiefly indebted to Matthew B. Hammond's pioneer study, *The Cotton Industry: An Essay in American Economic History*. Part I. *The Cotton Culture and the Cotton Trade* (Publications of the American Economic Association, New Series, No. I. New York: The Macmillan Co., 1897), and to Lewis Cecil Gray's invaluable *History of Agriculture in the Southern United States to 1860* (Washington: Carnegie Institution of Washington, 1933).

American agriculture. Eli Whitney's saw gin made it possible for short-staple varieties of cotton, which would grow on the uplands, to participate advantageously in the new market.

Not only was mechanically ginned cotton much cheaper than the textile fibers which had previously been in common use, but because of its spinning properties cotton was better suited than either wool or flax to the requirements of the early English power looms and spinning machines. It produced a superior product whose qualities were quickly recognized. As a result of the cost-reducing revolution in the textile industry, cotton clothing for the first time was brought within the reach of people in the lower income groups and rapidly became an article of mass consumption. The acute shortage of raw cotton which thereupon developed led at first to the stimulation of cotton growing in areas such as India and the West Indies, rather than in the southern American states, since the former were more plentifully supplied with hand labor. Once the principle of Whitney's invention became public knowledge, however, and despite Whitney's lifelong effort to regain control over the use of his invention and to establish a monopoly of toll ginning, commercial gins sprang up in the South with amazing rapidity. Within two years after Whitney completed his invention, local mechanics had set up gins in various parts of the South to the very edge of the Cotton Belt on the lower Mississippi. By the end of another year Whitney himself, in partnership with Phineas Miller, was operating thirty gins in Georgia alone.

In 1791, the entire American output of cotton was estimated at no more than 2,000,000 pounds, or the modern equivalent of 4,000 bales.³ By 1794 the total product, much of which was sea-island cotton, had risen to 8,000,000 pounds; and by 1804, with the increased ginning of short-staple varieties, this figure had been exceeded by more than eight times.⁴

The cotton gin supplanted the tedious and costly operation of separating by hand the lint from the seed; but in much the same way that the revolutionary improvements in spinning methods in England had for a time substituted a scarcity of weavers for a scarcity of spinners, the elimination of the processing bottleneck in cotton production merely shifted the acute need for an adequate supply of hand labor from the ginning shed to the field. Two heavy seasonal demands were

3. Hammond, *The Cotton Industry*, 21.

4. Gray, *History of Agriculture*, II, 681.

involved: labor for cultivation and labor for harvesting. A thorough-going mechanical solution for this set of problems has been achieved only very recently, and as yet in limited application.

Historically the problem was met by the greatly increased importation of African slave labor. Although slavery had long been a part of American colonial life, it was the expansion of cotton acreage which provided the great stimulus to the slave trade and the subsequent strenuous efforts to preserve the institution. In 1790 there were 697,697 slaves reported in the entire country. By 1860 there were 3,953,760, of whom the overwhelming number were confined to the South.⁵ The estimates assembled by Hammond make clear that by far the bulk of this labor came to be used in the cultivation of cotton. As cotton culture spread westward to the hill country of South Carolina and Georgia, into the black prairies of Alabama and Mississippi, through the alluvial lands of the lower Mississippi, along the river valleys of Tennessee, Arkansas, and Louisiana, and into East Texas, the introduction of slave holdings under the plantation system followed a similar pattern. Over a period of time the belief became widely established in the South that the successful production of cotton was absolutely dependent upon the availability of slave labor.

THE RETARDATION OF TECHNOLOGICAL ADVANCE

It is an anomaly that the cotton enterprise, which participated so early and so importantly in the Industrial Revolution, should thereafter have experienced only minor progress in production methods for well over a century.

There was, to be sure, some experimentation, especially in the early period, to devise more effective methods of cultivation. Planters tried various ways of preparing the bed and sowing the seed in order to secure an adequate stand with a minimum of thinning. New varieties of seed were introduced from time to time, both by importation from foreign cotton areas and by domestic crossing, in efforts to develop a longer staple, overcome disease problems, or to increase yields per

5. U.S. Census Office, *Return of the Whole Number of Persons within the Several Districts of the United States . . .* [First Census, 1790] (Philadelphia: Childs and Swaine, 1791), 3; *idem*, *Population of the United States in 1860* [Eighth Census, 1860] (Washington: Government Printing Office, 1864), xii.

acre. There were appreciable results from some of these efforts, notably in the form of higher yields, which made possible a considerable increase in the efficiency of hand picking.

The most significant innovation during this period, second only in economic importance to the invention of the saw gin, was the introduction into this country of the Mexican or Petit Gulf variety of cotton. General James Wilkinson is reported to have observed this cotton on one of his missions to Mexico City. When he requested the permission of the Spanish viceroy to take samples of the seed home with him and was refused, he stuffed some Mexican dolls intended as gifts for his nieces with the coveted cottonseed and thus managed to smuggle it into Mississippi.⁶ The varieties which had previously been grown here were subject to rot and had greatly deteriorated both in yield and quality. The staple became shorter, and the lint adhered so tenaciously to the small, tight bolls that it was difficult to pick. An average day's picking for a hand was 30 to 40 pounds of the upland black seed, and 75 to 100 pounds of the Tennessee green seed variety. After the Mexican variety came into general use between 1816 and 1820, a hand could pick 150 pounds in a day, and this was gradually increased to from 200 to 300 pounds, depending on the condition of the crop.

Various fertilization methods, such as the use of guano and the replacement of organic matter in the form of stalks and cottonseed, were tried out, but the high cost of importing organic fertilizer and the gradual development of a market for cottonseed more frequently led the early planters to solve the soil depletion problem by simply abandoning the land from time to time and moving farther westward. Such movements took place by stages throughout the nineteenth century and even into the twentieth. Since there was little livestock to begin with, and since the plantation system fostered extensive methods of cultivation, manuring was hardly feasible. Corn, essential to the feeding of both slaves and workstock, was grown as the principal supplementary crop, and this did not lend itself to the operation of a rotational plan such as the European three-field system; hence fallow-ing was rarely practiced as part of a farm management plan.

There gradually evolved during the pre-Civil War period a considerable variety of mule-drawn planting and cultivating implements.

6. James L. Watkins, *King Cotton: A Historical and Statistical Review, 1790-1908* (New York: J. L. Watkins and Sons, 1908), 13, 165.

Some of these were well adapted to local soil conditions and reflected strong planter preferences, but they were largely confined to local manufacture in the plantation smithies, and few came into widespread use. As late as 1880 the only implement which could be said to have been extensively adopted was an animal-drawn planter, and this had a negligible effect on the basic labor requirement for the crop. Of the various types of mechanical cultivators which were devised, none succeeded in actually supplanting the primitive hand hoe as a necessary tool.⁷

Some attempts were made, even before the Civil War, to reduce the labor involved in harvesting the crop by mechanical devices which would facilitate hand picking or replace the manual worker completely. Some of these inventions displayed considerable ingenuity, but none could compete with the readily available and relatively more efficient unaided hand worker.

Except for such improvements as have been noted, the essential character of cotton farming remained substantially unchanged until well into the twentieth century. It was a system which involved intense, and over a period of time, wasteful specialization in the production of a single staple commodity for which it was believed vitally necessary to maintain an abundant supply of low-cost labor. The institutions which grew up under this commercial regime, while they changed form under the impact of the Civil War, nevertheless preserved in their effects a continuous function, the essence of which was to maintain control over the labor force and hence over the distribution of the return. So long as the attention of cotton producers was centered almost exclusively in this direction, and so long as the institutions served their aim, it was unlikely that much attention would be given to alternative ways of carrying out the production process.

An ironic circumstance in the eras both preceding and succeeding the Civil War was that the completely servile character of the labor force came to dominate southern agriculture and to block the introduction of other enterprises that might otherwise have seemed desirable and feasible during sustained periods of depressed cotton markets

7. "The slight expenditure for agricultural implements is illustrated by the statement of DeBow writing in 1852 that on a South Carolina plantation of 4200 acres, 2700 of which were under cultivation, and where two hundred and fifty-four slaves were employed, the capital invested in all plantation tools and implements, including wagons, was only equal to \$1,262, and on an Alabama plantation of 1100 acres, with 120 slaves, the implements were valued at \$500." Hammond, *The Cotton Industry*, 78.

such as those of the eighteen-forties and nineties. Institutions which were pre-eminently suited to the production of cotton reinforced the necessity for producing nothing else, and thus tended to preserve conditions which were increasingly out of step with the remainder of American industrial and agricultural development. Chief among these institutions were the plantation system, chattel slavery, and the credit system.

THE PLANTATION SYSTEM

The plantation system provided the framework within which slavery, and later other means of labor control, were organized for maximum effectiveness. There were a number of characteristics of southern agriculture which lent themselves to large-scale organization. Slavery provided a stable labor supply which, though of limited adaptability so long as kept in illiterate servility, was under absolute control. Specialization in cotton and a few other staple crops, such as rice, tobacco, and sugar cane, furnished maximum continuity of employment because they were all-year crops of high cash value per hand. (It is significant that in the hill country of Virginia and the Carolinas, where settlers from the North commonly grew cereals, slavery proved unprofitable.) Women and children could be utilized in the periods of seasonal demand for hand labor, and since the methods of cultivation were comparatively simple and no complex machinery was required, the entire production process could readily be standardized and reduced to routine.

These characteristics afforded considerable economy in the cost of supervision of labor. In the Mississippi Delta shortly before the Civil War fifty slaves to an overseer was regarded as an efficient ratio, and occasionally a single overseer would superintend more than one plantation, each with as many as a hundred hands. In the eastern coastal region plow gangs of thirty to forty men and women were sometimes worked in common fields under one driver, or gang foreman.⁸

Another advantage of the plantation scale of operation was that certain fixed costs could be reduced, as by the construction of planta-

8. Gray, *History of Agriculture*, I, 546, 549. Very recently one could still observe a similar use of gang labor in some of the southeastern states, but in smaller groups of ten or twelve male hands, each with a Georgia stock and a mule. The use of labor gangs embracing entire families is much more common during the cotton picking season.

tion gins rather than dependence on commercial ginning, and by the more efficient utilization of workstock and such equipment as was required. Heavy shipments of cotton often gave the large producer a bargaining advantage in securing favorable treatment in respect to shipping, grading, and marketing. The large river bottom planter, who customarily dealt directly with the important factors in the port cities, also enjoyed superior access to credit, and this, together with the substantial profits available until about 1840, enabled him to outbid the small interior planter in the slave market. One of the results of this set of circumstances was a pronounced tendency toward increasing concentration of slave holdings, particularly in the bottom lands of Mississippi and the southwestern cotton region where the soil was most fertile and the productivity of slaves was highest.

It should be noted that most of the advantages of the plantation system which have been described stemmed from the powerful means of institutional control which it afforded, rather than from economies of scale such as are now commonly associated with the process of technological innovation and its tendency to require larger productive units and heavier capital investment. There was a substantial increase in the investment required by the large plantation up to the time of the Civil War, but it took the form principally of ownership of the labor force. The chief feature of the system, for those who benefited by it, was not its technological superiority but the absolute control over labor and consequent extreme disparity in income distribution which it facilitated. There developed a strong inclination on the part of planters to plow back their available funds into the same kind of investment which had generated them, even though toward the middle of the century there were increasing indications of inherent deficiencies in the system, especially in the older portions of the South. The belief that slavery was essential to the production of cotton had by this time become firmly implanted, and it undoubtedly contributed to the social rigidity and the economic inertia which were evident by the time of the Civil War.

Several writers, including some of those of the time, have raised the question whether, considering the low technological requirements of cotton production during the prewar period, it would not have been economically feasible to organize it within a more equalitarian social pattern such as prevailed in much of the rest of American agriculture; that is, a pattern which did not require the use of slaves and which

characteristically employed smaller farm units operated by independent yeoman farmers. Attention was repeatedly called to the settlements of German immigrants centering at New Braunfels, Texas, who were successfully raising cotton, a crop previously totally unfamiliar to them, on small diversified farms, and whose social organization represented an advanced European outlook. Negroes were in fact held in higher regard in these early communities than were the representatives of "Yankee" (that is, white southern) culture, who were distrusted as shiftless individuals addicted to shady dealings. Slavery was strongly disapproved in these settlements.⁹

Yet because of the competitive aspect of slavery and because of the extremely low social recognition given to all ordinary farm labor in the South by association with Negro servitude, an important effect of the existence of the institution was to discourage European emigrants from settling in the slaveholding states. Colonies such as those in central Texas, though locally successful, remained small, culturally isolated experiments, in contrast to the substantial European migrations which found their way into the farming areas of the Middle Western and North Central states, beginning before the Civil War and continuing into the early part of this century.

THE DECLINE OF THE PLANTATION ECONOMY

There has been considerable controversy among historians concerning the relation of slavery to the Civil War.¹⁰ Some have held that it was an exceedingly profitable institution for which southerners made no serious effort to find a substitute, as evidenced by their willingness to secede from the Union and thus precipitate a bloody fratricidal struggle in their attempt to preserve it. Hence slavery could have been eliminated only by the extreme coercive power of the federal government as it was employed in the Civil War.

Others have concluded that the institution had begun to outlive its usefulness well before the war and would have died of its own inade-

9. Frederick L. Olmsted, *A Journey in the Back Country* (New York: Mason Brothers, 1860), 306. Cf. Hammond, *The Cotton Industry*, 63, 98, and the account of Karl, prince of Solms-Braunfels, the enlightened leader of the German colonists, in *Texas, 1844-1845* (Houston: Anson Jones Press, 1936).

10. For an interesting sampling of historians' opinions in this area of controversy see Edwin C. Rozwenc (ed.), *Slavery as a Cause of the Civil War* (Boston: D. C. Heath and Co., 1949).

quacies if the issue had not been pressed so hard by the moral opponents of slavery at a time when other developments were complicating the problems of the South. These interpreters generally attach a good deal of importance to the southerners' fear that with the admission of additional nonslaveholding states to the Union, they would lose the necessary Congressional representation to block the adoption of restrictive tariff policies favorable to the industrial Northeast and unfavorable to the raw materials exporting South. Additional complications were the extremely depressed cotton prices of the decade of the forties, and the fear for a time that increased cotton production in India would become a serious competitive factor in the Liverpool market.

As is frequently the case in social dilemmas such as this, the circumstances as they affected various groups were highly mixed. It is undoubtedly true that, whether slavery was becoming decreasingly profitable or not, southern slaveholders could expect to sustain heavy financial losses (as they did) when emancipation took place, since this amounted to the enforced dissolution of their principal investment.

It should be recognized that for a number of the planters remaining in farming the dissolution amounted to a paper loss, since many were able after a time to reorganize their plantations with substantially the same labor force, who remained through loyalty or for lack of alternative employment and who now worked for wages or on shares rather than for subsistence as slaves. Now, however, the planter faced the necessity for meeting more of his operating costs in cash in advance of the crop (though it is not clear that the net costs of wage payments over those of slave maintenance were always higher), and this tended to render him more dependent on credit sources, of which more will be said below. Furthermore, it was no longer possible to sell off part of the labor force to provide for the maintenance of the rest—a practice often resorted to on unprofitable plantations—and no longer possible to retire from farming on the realized value of slaves. The most significant change during the reconstruction period was of course the advent of a new legal and psychological relationship between farm managers and labor which materially lessened the effective control over the work habits of the newly freed slaves. Eventually there was an adjustment on both sides to the new legal status of Negroes in which many of the older elements of control were re-established.

The loss of investment when the slaves were freed affected not only

the large cotton producers on the newer lands, who were the principal employers of slave labor, but the slaveholders in the border states and older farming regions, whose main enterprise—after the legal prohibition of the overseas slave traffic in 1808—became the breeding of slaves and their export to the southwestern states. As M. B. Hammond remarks,

The rapid exhaustion of the tobacco lands should have caused slavery to die out in Virginia and Maryland. But just as it was on the point of doing so, the cotton business sprang up and created such a demand for the slaves that the border states found great profit in raising negroes to supply this market. Henceforth slaves were seldom kept in these states for the sake of raising crops, but crops were often cultivated for the sake of raising slaves.¹¹

Despite the relative profitability of slavery for certain groups and the capital loss which emancipation entailed for them, it does not seem to have been generally foreseen that, as far as the availability of labor was concerned, the great majority of Negro freedmen would have little alternative to staying in the South and remaining in cotton farming. The chief institutional problem for the plantation operators was to find a morally acceptable way of organizing the same labor supply. Yet a secure solution for this problem was not worked out until after the war and the reconstruction period, that is, until the decade of the seventies.

Disadvantages of the Plantation System

There were certain inherent deficiencies in the operation of the plantation economy to which slavery contributed but for which it was not wholly responsible. These tendencies were visible, though generally ignored, well before the Civil War, and their prolongation undoubtedly abetted the economic stagnation of the region.

The principal deficiency of the plantation economy was the wasteful and destructive form of soil exploitation which it encouraged. Under the prevailing social system absentee ownership was fairly common, especially in the older regions. Reliance on overseers as plantation superintendents, whose efficiency was judged largely in terms of the size and profitability of the cotton crop, led to a failure to employ restorative soil practices, to exclusive cultivation of row crops

11. Hammond, *The Cotton Industry*, 54.

by extensive methods, to the neglect of roads and other local facilities, and to a general lack of interest in improving farming techniques. While cotton was not as heavily soil-depleting as some of the older, more intensive crops such as tobacco, the clean cultivation required by both cotton and corn subjected the land to erosion as well as to exhaustion of its mineral content. As newer and more fertile territories were opened up, the competition for slaves and in the sale of the product was keenly felt in areas where the soil had been allowed to deteriorate.

Another unhealthy tendency in the southern economy was the trend toward increased concentration of investment in slaves and a resultant overcapitalization of their value. Thus the investment character of slavery itself fostered the practice of "killing the land" of its virgin fertility and then moving on. "The habit of considering the negro slave rather than the land the investment," says Hammond, "made it easy and inexpensive for the planter to remove from one part of the country to the other. Capital and labor were united in the person of the negro slave, and the planter who had once decided to emigrate found it easy to take his property with him."¹²

Ulrich B. Phillips, in a study of the relationship of slave prices to the price of cotton during the ante-bellum period, concluded that allowing for increase in productivity, slaves became heavily overvalued by the time of the Civil War, and this made for a very unstable condition in the plantation economy.¹³ From 1800 to 1860 the price of slaves expressed in terms of cotton rose by 1,000 to 1,200 per cent. This rise was so great that it could only be explained as the result of severe competition among planters in selling cotton and buying slaves. After the legal importation of slaves from Africa was ended in 1808, slave prices in some years became subject to speculative excesses that were fairly described as "frenzied finance."

A sudden fall in the price of cotton was thus likely to drive the larger planters into immediate bankruptcy because so many of the slaveholdings had been acquired, directly or indirectly, through extensive resort to credit. In prosperous times the demand for funds to purchase additional slaves at ever-increasing prices was insatiable. Individual profits were consumed in the acquisition of labor, and

12. *Ibid.*, 88.

13. Ulrich B. Phillips, "The Economic Cost of Slaveholding in the Cotton Belt," *Political Science Quarterly*, XX, No. 2 (June, 1905), 257-75.

hence could not be used for more modern implements or land improvements. In the process working capital was turned into fixed capital. Planters were therefore often obliged to finance their purchases of supplies and articles of consumption by resort to credit from local merchants, who in turn owed northern merchants and bankers. This precarious structure of long- and short-term credit relationships rested upon the unstable base of the annual income from cotton.

A third deficiency of the system was its inflexibility, which stemmed to a considerable degree from the lack of versatility of the labor force which had grown up within it. The plantation system was dependent on a thoroughly routinized labor force which it was the deliberate policy of employers to keep uneducated—partly from a desire to utilize child labor, and partly out of fear of the consequences of an increased political and economic consciousness of the Negro population if it were permitted to become literate. The results were that experimentation with alternative enterprises was held to a minimum, output of cotton could not readily be curtailed in response to over-supplied markets, and there was little inducement for industry to locate in the South for the purpose of utilizing excess farm labor. According to Phillips,

In the operations of cotton production, where fluctuating and highly uncertain returns demanded the greatest flexibility, the slaveholding system was rigid. When by overproduction the price of cotton was depressed, it could be raised again only by curtailing the output in the American cotton belt, which had the monopoly. But the planter, owning cotton lands and slaves trained in the cotton field alone, found it hard to devote his fields with success to other crops or to sell or lease his negroes to any one else, for no one else wanted them for any other purpose than cotton production. In fact, the proportion of the southern resources devoted to cotton production tended always to increase. To diminish the cotton output required the most heroic efforts. As a rule, the chances of heavy gains from cotton planting outweighed those of loss, in the popular estimation; and the strong and constant tendency was to spoil the market by over-supply.¹⁴

These characteristics of southern agricultural labor made the region unattractive to new industry, which always had to run the risk that a sudden increase in cotton prices would draw the former field hands

14. *Ibid.*, 273-74.

back to farm employment. As has already been mentioned, the poverty and low social status of farm labor in the South also discouraged immigration of a better educated, more versatile form of free labor. These circumstances led Gray to conclude that, for the period to 1860,

Slavery . . . retarded the development of the compensating conditions—immigration and industrial diversification—which in the North alleviated the “growing pains” of agricultural expansion. Hence we have the near-paradox of an economic institution competitively effective under certain conditions, but essentially regressive in its influence on the socio-economic evolution of the section where it prevailed.¹⁵

Many of the conditions which have been here enumerated persisted long after the abolition of slavery, since the pattern which had been implanted during the developmental period of the American cotton economy tended to be self-reinforcing and self-perpetuating. Attitudes which had been formed during the period of vigorous geographic expansion and high profitability of the industry acquired the force of custom, and were intensified by the desire for sectional differentiation which marked the struggle between the North and South.

15. Gray, *History of Agriculture*, II, 942. For an opposing view, rather unconvincingly presented, see Robert R. Russel, “The General Effects of Slavery on Southern Economic Progress,” *Journal of Southern History*, IV (February, 1938), 34-54.

CHAPTER 2

The South Becomes a "Backward Area"

THE CIVIL WAR and its aftermath threatened for a time to disorganize completely the economic basis of southern agriculture, as it had severely disrupted the entire southern social structure. With the collapse of the capital values represented by former slave holdings, there was a sharp decline in all property values. Many large plantations were broken up and sold off at low prices to members of the "poor white" class who had formerly been degraded by enforced competition with slavery.

Yet the future of the cotton enterprise was not altogether hopeless, as many assumed. World consumption of cotton was growing and the superior American staple was highly desired on the Liverpool market. The price of cotton therefore continued relatively high during the immediate postwar years, and this encouraged a resumption of the one-cash-crop system, though in smaller units.

On the basis of these cotton prices, moreover, merchants were willing to extend credit to finance the new agrarian movement, and one of the results was that within a short period there was a remarkable increase in the amount of white labor engaged in cotton farming—not so much from foreign or northern migration, as from internal movement within the South. Hammond has estimated that the proportion of white to Negro workers on cotton farms was about one to eight

previous to 1860.¹ It was generally held at this time that the growing of cotton was unsuited to white labor. Nevertheless, by 1867 nearly 40 per cent of the field hands were white persons, and in some states white farm workers outnumbered Negro workers.

Henry W. Grady, who as editor of the *Atlanta Constitution* became a vigorous publicist for the program which he believed would create a "New South," wrote,

Never perhaps, was there a rural movement, accomplished without revolution or exodus, that equaled in extent or swiftness the partition of the plantations of the ex-slave holders into small farms. As remarkable as was the eagerness of the negroes—who bought in Georgia alone 6,850 farms in three years—the earth hunger of the poor classes of the whites, who had been unable under the slave holding oligarchy to own land, was even more striking. In Mississippi there were in 1867 but 412 farms of less than ten acres, and in 1870, 11,003; only 2,314 of over ten and less than twenty acres, and in 1870, 38,015.... In Georgia the number of small farms sliced off the big plantations from 1868 to 1873 was 38,824.²

REORGANIZATION AFTER THE CIVIL WAR: THE INSTITUTIONAL RESIDUE

There were, however, a number of expedients undertaken by those planters who sought to maintain the operation of their large land holdings. Immediately after the war some attempted to hire their former slaves for money wages, but this proved to be unsatisfactory to both groups. The planters found it difficult to obtain the necessary cash for wage payments, and the freedmen proved unreliable as farm labor, since they associated freedom with the right to spend money as it was received and to remain idle when so inclined. The planter incurred the risk that his labor might depart before the completion of the critical harvest season. Most of the cash wage arrangements consequently proved to be failures.

Out of this experience evolved the system of sharecropping which thereafter became the almost universal method of employing Negro

1. Matthew B. Hammond, *The Cotton Industry*, Part I. *The Cotton Culture and the Cotton Trade* (Publications of the American Economic Association, New Series, No. 1. New York: The Macmillan Co., 1897), 129-30.

2. Henry W. Grady, "Cotton and Its Kingdom," *Harpers' New Monthly Magazine*, LXIII (October, 1881), 721-22.

farm labor, and in later years, of substantial numbers of white labor. This system, which took a great variety of specific forms, in general made the farm worker assume part of the responsibility for the success of the crop, and offered him a share of the proceeds as his principal source of income. It reduced the risk to the landlord from a poor crop year that a fixed wage would have entailed. Because his share could not be determined or paid until the crop had been harvested, there was an inducement to the sharecropper to remain through the harvest.

A common arrangement which was soon reduced to custom and which has endured to recent times provided that the tenant who could furnish nothing but his own and his family's labor would receive half the proceeds of the cotton crop as his annual wage. The landlord furnished the land, a house and sometimes a garden plot, and all the implements and work animals. The sharecropper was expected to provide his own subsistence, but this was frequently advanced by the landlord in the form of four or five months' wages in the spring, to be deducted, usually with interest, from the final crop settlement. These advances, known as the "furnish," might be in kind, in the form of credit with a local merchant, or, less frequently, in cash.

The tenant who was able to provide his own tools, seed, and mules received a larger share of the cotton crop—usually two-thirds, but sometimes three-fourths—and a share of the corn crop sufficient to support his stock (usually three-fourths, hence the common term "third and fourth" to describe the rent of a share tenant). In a few areas the feudal custom of a standing rent—a fixed payment in kind—was preserved, but this arrangement tended to give way to the other types of share payment.

Deficiencies of the Sharecrop System

These forms of share tenancy, and their countless variants depending on local circumstances, succeeded on the whole in solving the primary problem of insuring a stable labor supply for cotton production, but they had a number of undesirable consequences. One of these was the system of coercions used to immobilize the labor force. The arrangement between planter and tenant took the form of an enforceable contract, though it was rarely reduced to writing. The legal device which was most frequently used to prevent the cropper from leaving his crop in mid-season, and when desirable, to prevent him

from moving to another farm after the annual settlement was reached, was systematic indebtedness. So long as the tenant remained in debt to his landlord he was obliged to stay and work off his debt. In times of labor scarcity this encouraged many landlords to levy excessive interest charges on advance wages or subsistence as a means of holding their labor.

Some of these arrangements were scarcely distinguishable from peonage, and they were often reinforced by the complicity of local law enforcement officers, who had little regard for the constitutional rights of Negro freedmen. Several states adopted "alienation of labor" laws which were designed to protect landlords or employers from having their labor hired away from them by other farmers or by contract labor agents who might offer higher wages during seasons of unusual labor demand. Farm hands who were attracted to new jobs by such offers were subject to forcible return by peace officers.

In addition to the direct compulsions applied to keep an abundant supply of cotton labor available, an important force operating in the same direction was the lack of alternative opportunities, especially for Negroes, outside of agriculture. Despite the energetic post-reconstruction efforts of the group of proponents of the "New South," industrialization was slow to enter the region, and when it did, it responded particularly to the availability of an impoverished white labor force, much of which was derived from unsuccessful farming in the older and marginal land areas. There was little room for illiterate, socially inferior Negroes in this development. Describing the carefully preserved harmony between the older agricultural tradition and the new movement for industrialization by invitation, the historian William B. Hesseltine has written,

Although these two traditions adhered to different ideals, there has been no major clash between them. Instead, there has been a division of territory and an exchange of experience between social ideologies. The traditions of the old South have been realized, to a large extent, in cotton, sugar, and rice; while the industrialization of the new South occurred in the mountain regions and the cities. There has been, too, a tacit agreement on the division of laborers. The agricultural regions rely largely upon Negro labor, while the mills draw their hands almost exclusively from the whites of the mountains or from the poor whites. The planters and industrialists have united in their attitude toward labor and have cooperated in politics to keep down the cost of government and to avoid excessive expenditures.

The philosophy of the old South, reminiscent of the pro-slavery argument, has served to prevent industrial revolt, and planter, politician, and industrialist have sedulously played upon race prejudice to continue their dominance in Southern society.³

Although there was an almost continuous drift of population from farm to urban areas and from the Southeast to other regions, especially in prosperous periods after the closing of the land frontier, the opportunities for Negroes to leave the predominantly agricultural South were extremely limited until the first World War. According to the earliest available migration estimates, only slightly more than 2 per cent of the Negro population left the eleven southeastern states during the decade 1890-1900, and less than 2 per cent during the decade following.⁴ In part these and subsequent losses through migration represented movements to other farm areas in the western part of the Cotton Belt. For this the depredations of the boll weevil as it marched eastward were largely responsible.

Most of the outmigration from the Southeast during the decade 1910 to 1920 was concentrated in the latter part of the period, which witnessed a heavy exodus of Negroes to northern and middlewestern industrial cities to secure employment during World War I. The mobility of Negroes rose with every succeeding decade, yet the loss in southern Negro population through migration regularly was more than made up by a high rate of natural increase.⁵ (This was likewise true for the white population.) It was not until the advent of the second World War that there was a sufficiently large departure of the basic cotton labor force to lend credence to reports of acute manpower shortages in portions of the Cotton Belt. The effect of this movement on the customary abundance of farm labor and the trend toward mechanization will be considered below in the course of this study.

Notwithstanding the devices used to insure the immobility of Negro farm hands and the low wage payments made possible by their unfavorable competitive position, there was perennial dissatisfaction in

3. William B. Hesseltine, *A History of the South, 1607-1936* (New York: Prentice-Hall, 1936), 648.

4. Rupert B. Vance, *All These People* (Chapel Hill: The University of North Carolina Press, 1945), 119.

5. Calvin B. Hoover and B. U. Ratchford, *Economic Resources and Policies of the South* (New York: The Macmillan Co., 1951), 21.

the South with the quality of Negro farm labor and an occasionally expressed belief that the presence of this unassimilated racial group contributed to the retardation of southern social and economic development. Some southern leaders voiced concern over the sustained drain of the younger, better educated, white population from the older states during the latter half of the century. They believed this trend toward differential migration would require an offset if industrialization and general economic progress in the New South were to be achieved. An energetic campaign was undertaken during the latter part of the century to attract to the region immigrants (especially those of North European "Saxon" extraction) who were then arriving in the northern American port cities in considerable numbers. The operators of the newly built railroads hired immigration agents to promote settlement along their routes, and were assisted by state immigration bureaus, industrial associations, and numerous immigration and development societies primarily interested in disposing of real estate. On the whole these attempts to attract settlers met with slight response, for reasons already mentioned, and the failure was particularly marked in areas already heavily populated with Negro sharecroppers, whom there was little disposition on the part of the prospective homesteaders to displace. Consequently the Negroes remained the principal farm labor supply in these areas.⁶

Not only did the sharecropper system as it became prevalent in cotton farming effectively continue the pre-Civil War dependence on a low-paid, land-bound labor force, but it perpetuated many of the destructive forms of soil husbandry which characterized the earlier period. Sharecropping encouraged irresponsible land practices since it once more reduced the need for close owner or planter supervision, often amounting to a return of the overseer type of plantation management. Furthermore, it facilitated the reinstitution of the one-crop system, which had been temporarily shaken by the wartime necessity to increase the food supply.

A high proportion of farm tenancy fostered a high rate of turnover in farm occupancy, with the result that tenant operators as a general rule showed little interest in the preservation of long-term soil fertility. The first census to collect data on farm tenancy in 1880 revealed that about 36 per cent of the farmers in the South Atlantic and South Cen-

6. Walter L. Fleming, "Immigration to the Southern States," *Political Science Quarterly*, XX, No. 2 (June, 1905), 276-97.

tral states were tenants and sharecroppers, as compared with 16 per cent in the North Atlantic states, 21 per cent in the North Central states, and 14 per cent in the West. By 1900 the proportion of tenants in the South Atlantic states had risen to 44 per cent, and in the South Central states to 49 per cent, whereas the increases in other regions had been much more moderate.⁷ The rate of increase in the tenancy ratio in the South for the decade from 1890 to 1900 has in fact never been exceeded, although it was approached during the decade 1920-30.⁸

RESUMPTION OF EXPANSION IN THE COTTON BELT

While the plantation economy in the Old South was undergoing reorganization into new tenure patterns prescribing predominantly smaller units, the westward movement to newly opened land in Texas and Oklahoma continued, and the geographic center of cotton production shifted accordingly. Harvested acreage and total production climbed almost continuously (Figure 1). Even in the older areas—particularly in the Carolinas and in Georgia—there was a general expansion of acreage in response to high prices after the Civil War, and production showed extraordinary gains. It was greatly augmented by an increase in yields per acre resulting in part from the application of commercial fertilizers under the more intensive cultivation of the new class of small farmers. Local deposits of marl and phosphates whose value had only begun to be appreciated shortly before the Civil War were now being extensively utilized.

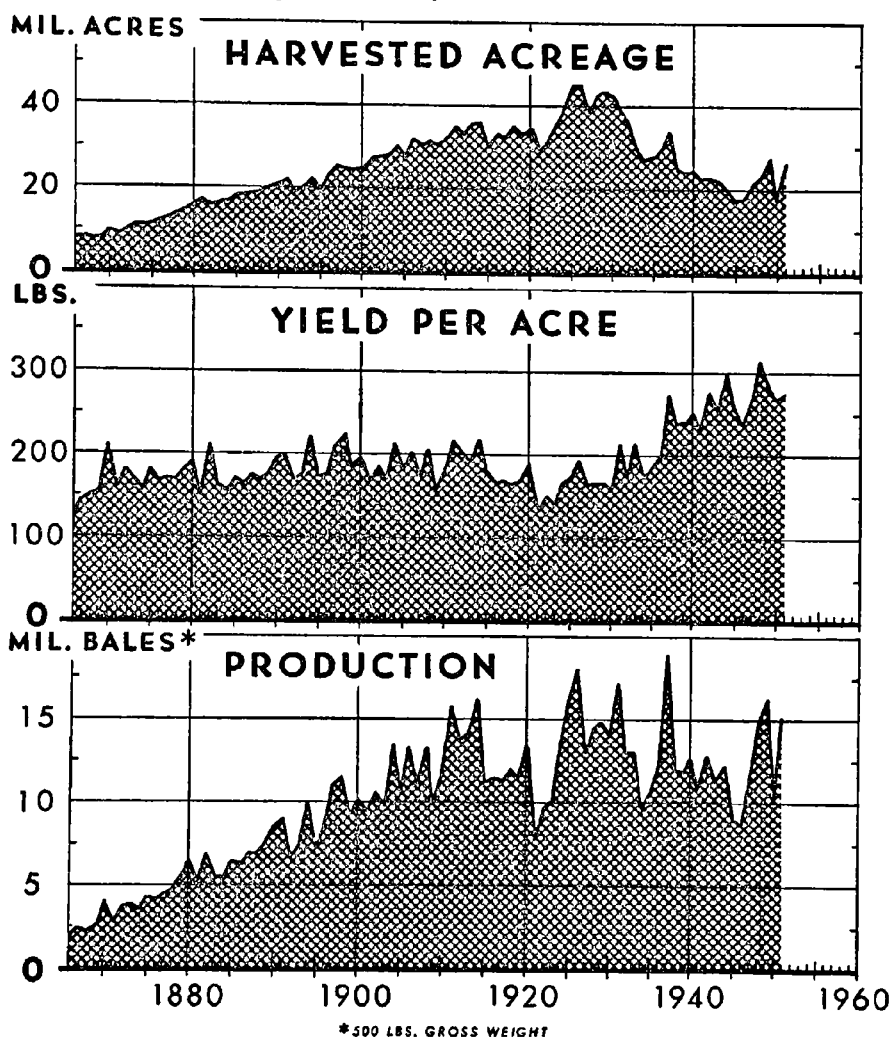
In addition to increasing yields, fertilization shortened the maturity of the plant, so that the range within which cotton could be success-

7. U.S. Census Office, *Twelfth Census of the United States, 1900*. Vol. V, *Agriculture*, Part I (Washington: U.S. Census Office, 1902), 688-89. The high tenancy rate in the Cotton Belt is partially accounted for by the fact that sharecropping is very largely confined to this region, and is classified by the Census as a form of tenancy, whereas it may also be regarded as a form of wage labor with wages partially withheld, and thus would correspond to hired labor in other areas. However, it is generally agreed by students of farm tenure that the tenancy problem in American agriculture in all of its aspects has been most acute in the South. Cf. Rupert B. Vance, "The Old Cotton Belt," *Migration and Economic Opportunity*, by Carter Goodrich and others (Philadelphia: University of Pennsylvania Press, 1936), 126-28; T. J. Woofster, Jr., and others, *Landlord and Tenant on the Cotton Plantation*, W.P.A. Research Monograph No. V (Washington: Works Progress Administration, 1936).

8. U.S. President's Committee on Farm Tenancy, *Farm Tenancy* (Washington: Government Printing Office, 1937), 35-39.

COTTON IN THE UNITED STATES

Acreage, Yield, and Production



U. S. DEPARTMENT OF AGRICULTURE

NEG. 48046-VX BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 1

fully grown was expanded and large new acreages in North Carolina were brought under cultivation. The effect was to arrest for a time the decline in the relative position of the seaboard states and to increase their proportion of the total American cotton output. Nevertheless, as the price of cotton began to fall from forty-four cents per pound in 1865 to seventeen cents in 1870 the cost of fertilizers became exceedingly burdensome and put many farmers heavily in debt to the merchants.⁹ In contrast to the western areas, which continued to hold a differential cost advantage in soil fertility, the eastern and hilly cotton areas had to depend upon the use of commercial fertilizers to maintain their output, and this rendered them particularly subject to ill effects from falling cotton prices. Fertilizer became a major cost-of-production item acquired from merchants on credit, and dealers customarily charged a substantially higher price for credit than for cash sales. This condition of widely disparate production costs in various parts of the Cotton Belt has remained a characteristic of southern agriculture ever since.

In 1878, the year after the Federal troops left the South, the cotton crop for the first time surpassed the 1860 prewar peak, which had been estimated at nearly five million bales.¹⁰ By 1894 this figure had been nearly doubled, and by 1911 it had been tripled. In the latter year the crop reached 15,694,000 bales, a figure which has been exceeded in only seven succeeding years (see Figure 1). Although there were intermittent poor years and allowance must be made for fluctuating yields from year to year, the trend toward larger production totals reflected a fairly continuous expansion of acreage planted to cotton, which reached a 36-million-acre peak in 1914 (ultimately to be surpassed by the 46-million-acre all-time record in 1925).

It is noteworthy that for much of the period of acreage and output expansion during the latter part of the nineteenth century, this movement took place in the face of an almost continuous and increasingly severe decline in the price of cotton from the abnormal height which accompanied the curtailment of production at the time of the Civil War to the trough near the end of the century. Cotton, which had reached a dollar a pound in 1863, fell in price from an average of 12

9. U.S. Bureau of Agricultural Economics, *Statistics on Cotton and Related Data* (Washington: U.S. Department of Agriculture, Statistical Bulletin 99, June, 1951), 4.

10. U.S. Department of Agriculture, *Agricultural Statistics, 1940* (Washington: Government Printing Office, 1940), 108-9.

cents a pound during the seventies to 9 cents in the eighties and 7 cents during the nineties. In 1894 it dropped as low as 4.6 cents.¹¹

By the last decade of the century the condition of the cotton enterprise was felt to be one of chronic depression, subject to overproduction and to prices which would no longer permit a satisfactory livelihood for the mass of small farmers. In addition to agrarian proposals for governmental reforms, such as the remonetization of silver and reduction of tariffs, which were heard in nearly all agricultural regions during this period, southern agricultural interests put forward a number of plans for the reduction of cotton acreage or for controlled marketing of the product.¹² Most of these plans provided for some form of voluntary agreement on the part of growers to restrict production and thereby to raise prices. They highlighted the dilemma of the individual cotton farmer operating under the classic conditions of a competitive market in which there were many producers, no one of whom could appreciably influence the price by varying his output, but who collectively influenced it powerfully and usually in the wrong direction. Short of abandoning the enterprise or radically altering his farming system, which the institutional framework virtually forbade him to do, the individual producer had no alternative when the price fell but to redouble his efforts to increase yield and output and thereby to try to uphold his income at prevailing market prices. But when all farmers succumbed to the same compulsions, the rate of increase in the total output was likely to exceed the increase in total consumption of cotton on the world market. Such voluntary schemes for crop restriction or marketing controls as were tried uniformly failed before the magnitude of the organizational task and the traditional individualism of the farmers concerned.

THE LOCAL CREDIT SYSTEM

The general condition of worsening economic tendencies in the South toward the latter part of the century was aggravated by the

11. *Ibid.*, 108.

12. Fred A. Shannon, *The Farmer's Last Frontier: Agriculture, 1860-1897* (New York: Farrar & Rinehart, 1945), chaps. XIII, XIV; Hammond, *The Cotton Industry*, 192-93. Similar proposals were revived in the twenties, with the emphasis on loans to cooperative associations for the purpose of holding cotton off the market. These efforts were rendered futile by the failure to solve the problem of the increasing annual carry-over. Cf. Hesselstine, *A History of the South, 1607-1936*, 652.

pervasive system of local credit which had come to dominate the cotton economy after the Civil War. Crop liens, which enabled planters to secure short-term credit by pledging the coming cotton crop with a factor in one of the leading market towns, had not been uncommon during the prewar ascendancy of the plantation system. In the troubled years following the war such liens were formally legalized in most of the cotton states in order to facilitate the extension of credit to the hard-pressed planters. The rapidly increasing number of small landholders, though they were unable to take advantage of such customary arrangements with distant factors, nevertheless utilized the new laws to acquire credit with local merchants.

These farmers, who generally had no mortgageable assets other than the forthcoming harvest, staked the success of the entire year's operations on the value to be realized from the cotton crop. The growing crop offered such uncertain security, however, and the sources of available credit in remote areas were so limited, that interest rates were usually very high.¹³ Furthermore it was often the practice of merchants to charge special prices on credit sales, which amounted to excessive carrying charges. For example, differences between cash and credit prices on staple food items, such as ham and bacon, were sometimes equivalent to annual interest rates on the cash price of from 40 to 110 per cent.

On the large plantation, since sharecroppers and other share tenants were subject to the landlord's lien on their part of the crop, they were virtually obliged to secure the necessary credit for supplies and subsistence from or through the landlord. Plantation operators arranged to borrow enough to finance the entire plantation and counted on the extension of credit to their tenants as one of the means of increasing their return on the plantation enterprise.

When there was a poor crop year in the locality or when prices fell

13. Writing in 1936, T. J. Woofter reported, "Another peculiarity of the cotton-credit system is that usury laws are inoperative. The legal rate of interest is a fiction. Credit is used, not for 12 months, but for from 3 to 8 months, yet interest is charged at a flat rate as if the loan were used for the full year. The most common practice is to charge a flat 10 percent. That is to say, a loan of \$100 will cost \$10 regardless of whether the loan runs for 3 or 8 months. If \$10 is charged for a \$100 loan of 3 months' duration this would be equivalent to \$40 for a full year, or 40 percent annual interest." *Landlord and Tenant*, 53. Such rates may still be in effect on a good many farms where landlords extend credit in the form of advances on the crop to their sharecroppers. Cf. Charles B. Ratchford, "Rental Arrangements in a Developing Economy" (Ph.D. dissertation, Duke University, 1951), 340.

by marketing time, the merchant-banker was often left with unpaid claims to be carried over into the following year and added to the cost of a new season's supplies for his customers. A succession of such years, as experienced in the Cotton Belt during the nineties and again on a large scale in the thirties, meant ruin not only for the cotton growers themselves, but for the merchants, local banks, and anyone else intimately linked in the credit chain. Thus large and small farmers and their suppliers alike were subject to a high degree of economic risk through the costly and precarious credit structure.

Yet because of the simple and familiar requirements of cotton culture and the ready marketability of the crop, the merchants traditionally showed a preference for cotton as security for the loans they granted. Thus for a long period in the history of southern agriculture the limited availability of credit had an appreciable influence on the failure of farmers to experiment extensively with alternative enterprises or more diversified types of commercial farming. So long as new and overdue liens lay against the current year's operations, there was a compulsion to concentrate on the time-honored cash crop in preference to untried enterprises. There were of course other factors working in the same direction, some of which have already been mentioned: the limited adaptability of the labor force, the absence of necessary equipment for new ventures, the lack of local markets, and undeveloped transportation and marketing facilities for distant sales of more perishable crops.

As in the case of many of the other institutions developed during the post-Civil War reorganization period in the older cotton states, the credit system tended to endure even through periods of crisis, largely for want of an alternative. Writing in 1897, Hammond recounts:

The credit system was thought to be dead in 1868 when the crop failures had ruined the factors who had made advances on the cotton. Again, in 1873 the system was thought to be crippled, and once more in 1881, at the time of the first Atlanta Exposition, the problem of southern agriculture was supposed to be forever solved. The enormous increase in the production of cotton since 1890, and the low price to which this staple had fallen by 1894, led merchants to refuse in many cases to grant further credit to their customers, and thus compelled a reduction of the acreage in cotton for 1895. This has once more led to optimistic prophecies in regard to the future. It is doubtful, however, whether the present tendency

to reduce the acreage of the staple will prove to be more than temporary. While the credit system remains as it is, the class of cotton raisers which needs most of all to maintain the smaller acreage, is unable to act independently in this matter.¹⁴

The growth in the number of country banks during the latter part of the nineteenth and early twentieth centuries provided a competitive element and reduced some of the inequities of the merchant credit system in a number of localities. But it was not until the federal government entered the field of short-term agricultural financing in the thirties that southern farmers had access to a type of production credit significantly less expensive, if not greatly different in purpose, from that obtainable from customary local sources.

THE SOUTH AS A "BACKWARD AREA"

In the foregoing historical review of the development of basic institutions in the Cotton Belt a pattern emerges whose outlines are familiar to students of the forces of inertia and change in the so-called "backward" or "underdeveloped" areas of the world—particularly those with a history of colonial development. While the American South is hardly to be compared today with the preindustrial communities of the world, its history presents striking points of resemblance with other undeveloped areas that experienced a period of rapid economic transformation under the typical process of colonial exploitation, and that thereafter continued for a relatively long period in a state of arrested economic and social development.

To summarize, the principal points of similarity with other underdeveloped areas which became organized under a colonial system are these:

(1) *An intense and highly specialized commercial exploitation of a basic extractive industry requiring little capital investment at the outset, and utilizing abundant undeveloped resources in combination with large quantities of unskilled, routinized labor.* In the case of the South, unlike the typical colonial area, it was not indigenous labor which was so utilized, yet the transplanted African natives who became the basic southern agricultural labor force were culturally so primitive and racially so easily distinguished as to lend themselves to ready exploitation under what amounted to a colonial system. It was thus in effect

14. Hammond, *The Cotton Industry*, 157-58.

possible to create in the South a labor situation not greatly different from that pre-existing in the more heavily populated colonial areas of the world.

It should be noted as a point of dissimilarity that the political independence of the American colonies after the Revolutionary War curtailed the opportunity and the incentive for some of the extreme instances of colonial exploitation recorded in those areas that served only to feed the economic interests of the mother country. Furthermore, in the American cotton region the growth of a free white population which could not be held in check by such a device as the exclusive crown grant likewise permitted an infiltration of yeoman farmers who gave the region a somewhat mixed institutional complexion. Even so, the interests of the dominant groups within and without the South were for a long period not oriented toward what might be called a balanced economic development of the region, but toward a perpetuation of the policies identified with colonialism. Commercially, the Cotton South was a colony of the Manchester mills long after the Revolutionary War.

As the economy of the United States became more closely integrated, especially after the Civil War, the South tended merely to shift its complementary relationship of specialization and exchange to a new locus of attachment. Such rail and other transport facilities as were constructed facilitated the maintenance of distinctly industrial and agricultural sections of the country. Though this arrangement was actively promoted by northern financial and industrial interests and was at times heatedly protested in the South, it was reinforced at almost every point by southern commercial institutions and long standing habits of thought.

(2) *The establishment of appropriate institutions of control within the region.* As we have seen, these consisted in the main of the plantation system and chattel slavery, succeeded by the sharecrop system, which was in turn bolstered by the local credit system. Not only are such devices, in a great variety of specific forms, associated with the typical methods of colonial labor organization, but they exist in the agricultural economies of many native cultures, such as those of China and India. When the rural population displays a tendency to increase while economic opportunities remain limited in a laggard economy, the burden of an exploitative labor system becomes increasingly onerous.

It is therefore understandable that in periods of acute economic distress and political upheaval, one of the strongest revolutionary appeals to the agricultural population in such areas is the proposal for land redistribution and for regulation or abolition of the money lenders, regardless of the improbability that such reforms will bring about an increase in the total agricultural output to be shared. In the more densely populated parts of the world the man-land relationship is such that an increase in aggregate output is unlikely to result from a redistribution of land alone. A land reform movement typically seeks to effect a more equitable distribution of the available income from farming, as well as to provide security of tenure for a growing rural population which presses upon the limited land area, rather than to try to effect a fundamental technological reorganization of farming for greater output and a readjustment of population to land resources. In the following chapters we shall see how the recent history of the South illustrates, first, a limited and abortive land reform movement of the agrarian sort, instituted as a matter of public policy (in the thirties), followed by the beginnings of a rather haphazard process of technological reorganization and population readjustment whose eventual course of development is still uncertain.

(3) *Demographic characteristics of a predominantly rural culture which has begun to be affected by technologically more advanced areas.* Insofar as it is possible to generalize on the basis of limited population data, it appears that preindustrial communities are commonly characterized by relatively high birth and death rates. As such areas come into contact with regions possessing superior knowledge of medicine and sanitation, the dissemination of this information and the introduction of new modes of life have a tendency to lower the death rate. The economic factors and folkways governing the birth rate are not likely to respond so rapidly to new conditions, however. Fertility patterns related to the need for large numbers of young farm workers tend to persist after the need has begun to decline, and the consequence of a birth rate which falls less rapidly than the death rate is an acceleration in the rate of natural increase. The reaction to the resulting population pressure may take various forms, depending upon the available opportunities: expansion of the land frontier, subdivision of land into smaller farms, migration from the area, or urbanization. The history of the Cotton Belt illustrates a combination of all these expedients, the relative intensity of each varying as conditions have changed.

(4) *A failure to make vigorous use of available technological alternatives to customary production methods.* This is the generalization within this group which is perhaps most difficult to substantiate conclusively, since it is obvious that there are many factors which influence the rate of technological innovation other than mere willingness to use the inventions that have been made. In the case of the American cotton economy, as the discussion in Chapter 5 will show, a complex series of technical obstacles had to be overcome before the complete mechanization of cotton production could be regarded as practicable. Because of the two seasonal labor demands and the difficulty of standardizing the conditions of production, this achievement has required a number of complementary inventions, as well as the application of a variety of chemical and biological techniques. It will be instructive to consider the history of the early attempts to mechanize cotton production (most of them concerned with replacing hand picking) which failed. Many such attempts were recorded before the concentrated, flexible application of modern tractor power was available, and the tractor has unquestionably greatly facilitated the successful mechanization of cotton production.

Furthermore, a truly widespread application of the mechanical methods at hand remains to be made, and until it has, the assured technical and economic practicality of these methods for the entire region must be regarded as not fully demonstrated. Successful inventions do not occur simply because there is a need for them; and under the best of circumstances one must expect some time lag between invention and application which is not due merely to indifference on the part of potential users of the invention.

Notwithstanding these qualifications, however, it is also fairly clear that the rate of innovation can to some degree be forced by active research and by the vigorous sponsorship of the more enterprising producers in an industry. In thinking of the South as a "backward area" one must not lose sight of the fact that the region has been closely linked by language and general culture, by geographic and political contiguity, and by free social and intellectual intercourse with the rest of the country. In light of the general process of industrialization which had long been going on in the United States and in light of the technological advances in other major farming regions, one is impelled to ask, why was mechanization so slow to penetrate the principal commercial enterprise of the South?

Ordinarily it is change, rather than inertia, which appears to warrant explanation. The answer to the above question therefore may seem to have little significance. If, however, what may be said about the process of economic change in one part of the world has any relevance for other parts of the world, and if, indeed, the outlines of a general theory of economic development are taking form, such a theory should contain an answer to a question of this sort. An explanation of the fact that some parts of the world move ahead, technologically speaking, involves asking why some parts stand still for generations at a time.

In regard to cotton production it is fortunate for the purposes of analysis that the possibility, if not the probability, of technological reorganization is now visible, and the factors impelling the change are likewise discernible. By inquiring into the reasons for the recent acceleration of technological advance in cotton production, one may at the same time discover why factors such as these failed to operate earlier.

It is the belief of the present writer that for at least the period since the advent of the tractor the stultifying effect of southern social and economic institutions has been a greater factor than the existence of technical difficulties in explaining the slow rate of progress in the mechanization of cotton production and the lag in the general rationalization of southern agriculture as well. The overriding circumstance in this process has been the availability of a routinized, poorly educated, and politically ineffectual rural labor force which for a long period rendered sustained inventive and developmental interest in labor-saving farm machines economically pointless. Until the existing population distribution and the institutional structure embracing it were seriously jarred by the impact of outside events, there was an irresistible predisposition to try to solve the problems of the cotton economy by institutional makeshifts rather than by technological reorganization.

The conclusion for a general theory of economic development is evident: The rate of economic development is dependent not simply upon the availability of technical "know-how," but also upon regional population characteristics and the rate at which existing social institutions will permit changes to occur. While it is generally recognized that every economic process is carried out within a specific framework of institutions, the force of those institutions is frequently underestimated.

CHAPTER 3

Cotton Farming as a Distress Industry

AFTER THE TURN of the century there was a general improvement in economic conditions in the Cotton Belt. Within the first decade and a half a substantial increase took place in the total acreage harvested, and production continued to show a phenomenal uptrend (see Figure 1). Because of weather and insect difficulties, however, the increase in output was not proportional to the increase in acreage, while the demand for raw cotton was increasing both in the United States and abroad. As a result, prices for most years were well above those of the nineties.

Not all areas of the Cotton Belt shared uniformly in the returning prosperity, and for the region as a whole the improvement in conditions proved to be a temporary one. It was disrupted by a series of events over which cotton growers had little control and which, over a period of time, lent color to the growing belief that cotton production was a permanently declining industry. Among these were the alarming spread of the boll weevil and the effects of World War I on the market.

FACTORS IN THE PROSPERITY OF THE EARLY CENTURY

Several factors contributed to the improvement in conditions before World War I. One of these was the growth and dispersion of the

world market. A great increase in demand had taken place in Europe, particularly in the growing textile industry on the Continent, and the demand was met for the most part by American cotton. There had also been a considerable growth in the number of American textile mills, especially in the South after about 1885. As late as 1880 the total southern consumption of cotton had been only about 13 per cent of that of the northern states. By 1910, despite a considerable increase in the consumption of northern mills, over half of the American manufacture of cotton took place in the South.¹ The development of the textile industry in the Far East was also getting under way, and for a time American cotton was able to participate importantly in this market. Taken together, these developments meant that the South was no longer dependent on a single principal source of demand and that market tendencies were more subject to the steady influence of counteracting cyclical forces in various parts of the world.

There were also improvements in the marketing mechanism during this period, including the development of interior buying, the establishment of new cotton exchanges, and the rise and growth of the system of purchasing cotton for future delivery. It is by no means certain that these institutions have invariably reduced the unstabilizing effects of speculation in the cotton market, or that the benefits of a more efficient trading machinery have accrued as much to growers as to other elements in the market. Yet prior to the severe curtailment of continental demand brought about by World War I, the general disposition of an increasingly sensitive world market appears to have been to smooth out short-term variations in supply and demand conditions, and thus to reduce the year-to-year uncertainties in planning farm operations.

Another factor contributing to the improved position of cotton growers during the early part of the century was the expanding market for cottonseed, which yielded four useful products: oil, meal, hulls, and linters. In 1872, out of a total of 1,318,000 tons of cottonseed produced in the South, only 53,000 tons were used in the oil

1. Matthew B. Hammond, "The Extension of the Cotton Belt and the New South," *Readings in the Economic History of American Agriculture*, edited by Louis Bernard Schmidt and Earle Dudley Ross (New York: The Macmillan Co., 1925), 429-30; Everett E. Edwards, "American Agriculture—The First 300 Years," *Farmers in a Changing World, The Yearbook of Agriculture, 1940* (Washington: Government Printing Office, 1940), 239.

mills. By 1909, out of 5,904,000 tons produced, 3,670,000 tons were so used.² No longer was the seed simply discarded by dumping it in the bayous, as had often been the practice in some of the western areas, nor was it so extensively utilized in its crude form as fertilizer or hog feed. The value of cottonseed in relation to that of the lint cotton increased appreciably during the period immediately before World War I, and increasingly the seed was thought of as a significant part of the cash crop.

EXPANSION INTO WESTERN IRRIGATED AREAS

The second decade saw the beginning of a vigorous expansion of cotton acreage in New Mexico, Arizona, and California—a trend which has continued to the present, although at a decreasing rate as suitable areas began to fill up, and with cyclical interruptions in 1921, 1927, and 1932. Unusually rapid increases in production were recorded in the three western cotton states during the early expansion period. These are principally irrigated areas, subject to different production methods and much greater yields than those of the older cotton areas. Moreover, these areas, together with the High Plains of Texas, which came into cotton production at about the same time or a little later, have distinctive institutional histories which have undoubtedly affected their rates of technological innovation. Land has characteristically been farmed in larger units, and although tenancy has been common, sharecropping as practiced in the eastern regions never became firmly established here. There has been much greater dependence on mechanized cultivation and migratory casual labor, heavily drawn from the Mexican and Mexican-American populations to the south.

ADVERSE INFLUENCES DURING THE INTER-WAR PERIOD

Two critical occurrences which were to affect the American cotton economy profoundly were gathering force during the period of comparative prosperity preceding World War I and ending with the short boom period immediately after the war. These were the boll weevil infestation and the decline of the dominant American position in the world market. Then, too, the war itself contributed to the un-stabilization of the conditions of production.

2. Hammond, "The Extension of the Cotton Belt," 433.

The Boll Weevil

The boll weevil entered the United States at the southern tip of Texas in 1892 and spread north and east by stages in successive crop years, reaching all except the most northern and the western irrigated areas by 1922.³ It did not begin to take its first heavy toll, however, until 1909 and 1910, by which time the center of infestation was in Louisiana. The first acute reduction in harvested output in Mississippi took place in 1913, in Alabama in 1916 and 1917, in Arkansas in 1921, in Georgia in 1921 and 1922, and in South Carolina in 1922.

For the Cotton Belt as a whole, the boll weevil had severe effects on acreage planted, on yields, and on total production. It led to desperate attempts to find alternative enterprises, and to considerable internal migration to escape the areas of greatest infestation. It has been estimated that the average annual loss resulting from boll weevil damage during the period 1910 to 1928 was 12 per cent of the total crop.⁴ The heaviest losses occurred at intervals of about five years, in 1916, 1921, 1927, and 1932. The greatest reduction took place in 1921, when the loss amounted to over 30 per cent below estimated full yield. An indirect long-term effect on yields and on quality resulted from the loss of many excellent varieties of long-staple upland cotton and nearly all of the better varieties of medium-staple, which had to be replaced with somewhat inferior varieties that would mature early enough to escape at least some of the ravages of the insect.

A succession of years of heavy losses, which in some areas meant that cotton yields fell to less than 10 per cent of former levels, brought about an almost complete breakdown in local institutions and an utter demoralization of cotton farmers. Rupert B. Vance, O. M. Johnson, Arthur Raper, and others have provided vivid descriptions of the drastic consequences for the Piedmont of low yields which coincided

3. William C. Holley and Lloyd E. Arnold, *Changes in Technology and Labor Requirements in Crop Production: Cotton*, W.P.A. National Research Project Report No. A-7 (Philadelphia: Works Progress Administration, 1938), 92-95. See also in connection with the following discussion: Rupert B. Vance, *All These People* (Chapel Hill: The University of North Carolina Press, 1945), 134-38; Edward E. Lewis, *The Mobility of the Negro: A Study in the American Labor Supply* (New York: Columbia University Press, 1931), 15, 104-6, 115-17.

4. J. A. Hyslop, *An Estimate of the Damage By Some of the More Important Insect Pests in the United States* (Washington: U.S. Bureau of Entomology, mimeographed, December 31, 1930), 4.

with the low prices of the postwar deflation years, 1920 to 1922.⁵ This section of the Cotton Belt was near the margin of cultivation, but farmers in the preceding years had expanded their cotton acreage in response to wartime prices. Most of the farming was done by tenants, about half of whom owned no workstock. According to Vance,

Absentee landlords had turned much of the function of supervision over to the "time merchant" who provided living supplies to tenants at high credit prices. Such landlords, disinclined to check up on crops produced and the care of workstock, exacted a standing rent of an agreed number of bales of cotton, and encouraged the tenants to own their mules even if mortgages left them but a bare equity in the animals.

The weevil invasion, it is evident, fell heaviest on this type of farming. With crop failure, the tenants lost their mules to the banks, while owners, deprived of their rents, were unable to secure work animals even on credit. While the workstock declined, the croppers increased in number. Had the workstock of those owning no land been evenly divided among the landowners who had no horses or mules, there would have been 40 acres per animal in 1920 and 141 acres per animal in 1926. What happened, as a result, was that planters without workstock saw their acres go untilled, while tenants lacking animals were compelled to leave farming. The ruin of the banks completed the cycle.⁶

The disastrous experience with the boll weevil, combined with low prices and the cumulative effects of years of soil erosion, impelled a heavy outflow of population from the older cotton areas. Many of the displaced farmers, both white and Negro, responded to opportunities in more prosperous urban areas, but some of them migrated westward to agricultural sections which had already experienced partial recovery from the earlier effects of the insect. The greatest decline in number of farms during the period from 1910 to 1930 was in the Piedmont and Coastal Plains areas of Alabama, Georgia, and South Carolina, where, incidentally, the sea-island cotton industry met total destruction and the coastal area was for a time taken entirely out of cotton production. The cotton areas which showed the greatest gains in numbers of farms were in Louisiana, Arkansas, and Mississippi, and the

5. Vance, *All These People*, 134-46; O. M. Johnson, *The Old Plantation Piedmont Cotton Belt* (Washington: U. S. Department of Agriculture, preliminary report, mimeographed, May, 1930); Arthur Raper, *Preface to Peasantry: A Tale of Two Black Belt Counties* (Chapel Hill: The University of North Carolina Press, 1936).

6. Vance, *All These People*, 136.

areas with the greatest gains in acreage were in Texas and Oklahoma.

The westward flow of population was accompanied by an increase in the proportion of tenancy in the regions of new location, which suggests that there was some tendency for the migrating farmers to carry their old institutional arrangements with them, though their general state of destitution was of course the primary reason for their inability to buy land.

In the Southeast, as Arthur Raper has pointed out, the general collapse of the credit system had the paradoxical effect of bringing about the abandonment of the more fertile lands while many submarginal farms remained in cultivation. Never having had access to credit, the operators of these farms had had to practice a diversified form of agriculture in which they supplied a considerable part of their own subsistence, and thus they were least affected by the credit debacle. As a group, however, they were relatively insignificant contributors to the production of cotton, and their scale of living was low.⁷

Eventually there was partial recovery in the eastern cotton region, as farmers learned methods of insect control suited to local conditions. These included earlier planting, changes in plant spacing, the increased use of fertilizer, the substitution of early-fruited varieties, and poisoning with arsenical dusts. Yields once more improved, acreage that had been abandoned or temporarily devoted to other uses was returned to cotton, and a return flow of population ensued, particularly as urban employment opportunities fell off during the thirties. Despite the devastating inroads of the weevil on the growth of cotton, there were remarkably few permanent transitions to other crop enterprises. This is apparently to be explained partly in terms of the highly institutionalized tradition of the one-crop system, which has been described, and partly in terms of the failure to discover feasible alternatives in light of existing market conditions.

The Effects of World War I

The prolonged difficulties with insect infestation, together with the loss of the important German market which followed hard upon the record 16-million-bale crop of 1914, largely explain the failure of the cotton region to share as vigorously in the agricultural boom of World War I as did most of the other farming regions of the country. The initial effect of the war in Europe was to produce a feeling of dis-

7. Raper, *Preface to Peasantry*, 221.

couragement in the South, since the loss of export markets was foreseen. Even though cotton consumption in the United States increased somewhat, the war reduced the net world consumption of American cotton about 12 per cent, on an average, below such consumption in the three years preceding the war.⁸

With American entry into the war, however, cotton began to participate in the general rise in commodity prices. For the three years from 1917 to 1919 the average price received by farmers exceeded twenty-seven cents a pound, and in the last year it reached thirty-five cents. The total value of the American cotton crop reached two billion dollars, a record not to be equaled again until 1948. In commenting on this period, A. B. Genung remarks, "The stimulation to cotton prices thus came largely at the end of the war and more as a result of domestic business activity, general inflation, and moderately small crops than from actual war demand."⁹

The beginning of the inter-war period saw a sharp fall in price, followed by two years of severely curtailed acreage and output. In 1920 the average price of cotton received by farmers fell from thirty-five cents to sixteen cents, and the following year, which happened to be the worst boll weevil year, land in cultivation was reduced from thirty-six million acres to thirty million acres. Total production fell from twelve and a half million bales to eight million bales (see Figure 1).

The Decline in the American World Market Position

Although the Cotton Belt did not perhaps suffer as acutely during the ensuing period from the aftermath of rapid wartime expansion, increased mechanization and labor displacement, inflated land values, and sudden collapse of export markets as did the food-producing regions of the country, it became increasingly evident during the twenties and was brought sharply home in the thirties that a major change had taken place in the relative position of American cotton in

8. All references to cotton prices, production, consumption, and related data in this and subsequent chapters were obtained, unless otherwise noted, from *Agricultural Statistics*, an annual publication of the U.S. Department of Agriculture; and *Statistics on Cotton and Related Data* (Washington: U.S.D.A., Statistical Bulletin 99, June, 1951), and *Supplements for 1952, 1953, and 1955* (July, 1952; July, 1953; and November, 1955, respectively).

9. A. B. Genung, "Agriculture in the World War Period," *Farmers in a Changing World, The Yearbook of Agriculture, 1940*, 285.

the world market. This was a long-term development resulting from the gradual increase in foreign growths—a trend which was accelerated in the decade beginning in 1928. It was also associated with the new role of the United States as a creditor nation, and the failure to adopt war debt and tariff policies which would facilitate the continuation of a strong agricultural export market.

During the greater part of the nineteenth century the United States had been the only nation producing a significant quantity of cotton for export. American production in 1891 is estimated to have formed about three-fourths of the world's total output.¹⁰ By 1916 the American portion had declined to about three-fifths, and by 1933 it was less than half. Foreign production has exceeded that of the United States in every succeeding year except 1948 and 1949, though this country remains the world's leading producing nation. In terms of world mill consumption, the American contribution fell as low as 39 per cent by 1937, and has rarely exceeded 50 per cent in subsequent years.

As countries such as India, China, the U.S.S.R., and Brazil increased their cotton production, they tended to increase their capacity for textile manufacture, which meant that a smaller proportion of the world's raw cotton entered into international trade, and also that English mills, traditionally a strong market for American cotton, experienced increasing difficulty in finding markets in the areas of home manufacture. Another factor affecting the American export market during the thirties was the attempt of European countries to achieve national self-sufficiency in the face of depression and impending war. This stimulated research in synthetics and fostered the development of the continental rayon industry, thereby threatening to reduce permanently the European dependence on cotton as a basic textile fiber.

THE EFFECTS OF THE GREAT DEPRESSION

The general economic depression of the thirties intensified to an acute degree the problems inherent in the long-term trends in southern agriculture. These were the problems of surplus production, soil deterioration, excess farm population, and inefficiencies in farm management and adjustment, which will be reviewed in turn.

10. U.S. Agricultural Adjustment Administration, *'Round the World with Cotton* (Washington: Government Printing Office, 1941), 38.

The Problem of Surplus Production

The belief that agricultural production had been overexpanded during the first World War became quite general among American farmers after the sharp break in farm prices in the summer of 1920, and a number of "surplus disposal" plans were put forward. Most of these plans sought to segregate the domestic market from the export market, through the use of protective tariffs and export subsidies, in order to insulate domestic farm prices from the competitive effects of foreign agricultural production and to restore prewar relationships between domestic agricultural and nonagricultural price levels. The McNary-Haugen bills, which were before Congress in varying forms from 1924 to 1928, embodied such plans and twice received Congressional approval, only to be vetoed by President Coolidge in 1927 and again in 1928.

Organized cotton growers, who had long thought of themselves primarily as producers for an export market, did not at first support these proposals. Traditionally opposed to the protective tariff and to increased federal powers, they were inclined to rely upon privately organized marketing cooperatives to stabilize prices and to prevent or dispose of surpluses. After the 1926 crop season, however, when the world carry-over exceeded twelve and a half million bales, 62 per cent of which represented American cotton, and the average price received by farmers had dropped in one year from 19.6 cents to 12.5 cents, there was a growing recognition of the impact of foreign growths on the world market and of the inability of American voluntary associations to deal with the problem effectively (see Figure 2). Many of the essential features of the unsuccessful legislation of the twenties, including the concepts of governmentally supported parity prices and of a segregated, subsidized export market, were eventually accepted by southern farm groups and were put into effect in the thirties.

The shrinkage in the domestic market which accompanied the onset of the depression in the United States, together with the curtailment of foreign demand stemming from the cessation of American lending and the operation of the Smoot-Hawley Tariff, resulted in a rapid worsening of the surplus problem. By the end of the 1931 crop season the world carry-over exceeded eighteen million bales, 72 per cent of which was American cotton. The average price received by farmers had fallen to 5.7 cents, the lowest it had been, with the exception of

1894, since before the Civil War. Gross farm income from cotton, which had already been regarded as unsatisfactory during the twenties, was reduced to little more than a third of the average for that decade.

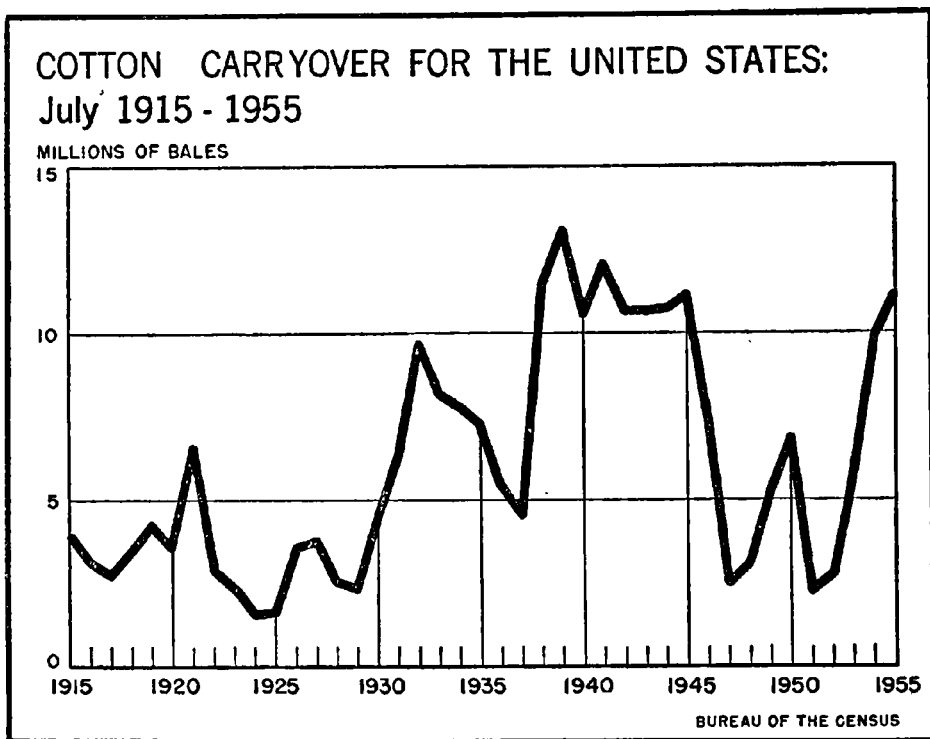


FIGURE 2

Note that this chart represents stocks of domestic and foreign cotton on hand in the United States at the end of each marketing season and does not include surpluses of American and foreign cotton held abroad, which help to make up the world carry-over.

Governmental efforts to deal with the problem of excess production took two forms: crop reduction and surplus removal. Under the Agricultural Adjustment Act of 1933 the Government sought to effect a severe reduction in acreage harvested. The program was not put into operation until the midst of the 1933 crop season, however, and it was therefore necessary to plow up growing cotton in an effort to secure a 40 per cent reduction in harvested acreage. The following year plantings were restricted, and a severe drought in the western part of the region contributed to the reduction of output. In succeeding years the program met with faltering success as farmers learned to

retire their poorest land and to intensify the fertilization and cultivation of the acres they were permitted to plant. Within a space of three years yields rose enormously (see Figure 1).

This tendency was in fact encouraged by the terms of the Soil Conservation and Domestic Allotment Act of 1936, which was enacted to replace the 1933 measure after it had been declared unconstitutional by the Supreme Court. The new act promoted soil conservation and improvement as an alternative to the soil depleting practice of exclusive cotton growing. Yet as a means to insure continued acreage control and crop reduction it proved largely impotent. The cotton acreage under cultivation, which had been reduced to twenty-eight million acres in 1934, had again increased to thirty-four million acres by 1937. The American output in 1937 reached nearly nineteen million bales, the highest on record, and formed the principal basis for an increase in the world carry-over that crop year from 13,695,000 bales to 22,702,000 bales.

A stronger and more comprehensive crop control law was put into effect in the following year. The Agricultural Adjustment Act of 1938 provided for a system of acreage allotments, individual marketing quotas with penalties for excess production, price-adjustment (parity) payments, soil conservation payments, and crop storage loans whereby the Government in effect acquired ownership of the greater part of the production otherwise unsalable at stipulated percentages of parity prices. Although this combination of measures succeeded in bringing down the 1938 output to twelve million bales, which was nearly two million bales below the average for the decade 1923-32, the record crop of the previous year overhung the market, and prices responded only sluggishly. The combined result of the low prices and reduced production was a gross farm return from lint cotton in 1938 only about two-fifths as large as the average during the twenties and only slightly above that from the 1931 crop.

The effect of removing the cotton surplus from the immediate market through crop storage loans was to impound large undisposable stocks in Government possession and to impede the flow of American cotton into export channels, since the world market price was well below the American loan price. While the United States had been reducing its cotton output, India, her nearest competitor, rapidly reversed the depression trend toward curtailment and was able to capture a larger share of the world market. The Soviet Union and

Brazil also expanded acreage and production very substantially during this period. After 1935 the Soviet Union took no American cotton until approaching hostilities stimulated a renewed desire for imports.

By mid-1939 the American Congress was able to overcome its earlier reluctance to sanction international commodity dumping and enacted an export subsidy program by means of which American cotton was again able to enter competitively into the world market. A resumption of vigorous export trade ensued, spurred by European preparations for war, but it lasted only about a year, for with the actual outbreak of the war and the initial German military success most of the continental market for American cotton was cut off.

In view of the oppressive stocks on hand and the continued large annual growths of new cotton during the depression decade, the Department of Agriculture and other interested groups considered various proposals for the diversion of the cotton surplus into domestic channels of consumption, but in ways that it was hoped would not interfere with normal marketing and prices. Efforts were made to provide relief outlets similar to those used by the Surplus Commodities Corporation for foodstuffs and to find new or expanded commercial uses for the product through research and sales promotion, but most of these efforts had minor results. A mattress and clothing distribution plan was patterned after the moderately successful Food Stamp Plan. It sought to reduce the cotton surplus at both the demand and supply sources by rewarding cotton growers with some of their own product in consumable form in return for small voluntary acreage reductions in addition to those already required by the crop reduction program. Not only was the program very costly to operate, but it proved unacceptable to most farm operators, who preferred all of the cash income they could secure from their already limited acreage to payments in kind. Even in areas where impoverished sharecroppers would have materially benefited by the contemplated clothing distribution, the plan was heavily resisted by influential planters, who regarded it as an undesirable interference with the established system of distribution of the return from their land. Less than a half million bales of cotton were disposed of under the mattress and clothing programs, and as it was apparently impossible to devise an acceptable modification of the program which could be continued, the attempt to dispose of surplus cotton in this way was soon abandoned.

Research in new uses for cotton uncovered no major new market,

and some of the outlets suggested and seriously experimented with, such as the use of lint cotton to make paper and the use of cotton duck as a binder for road surfacing, were either so uneconomic or offered such minor outlets as to do little more than to exhibit the desperation of the times.¹¹

At the same time, there was a visible tendency for substitutes such as paper and jute to replace cotton in some of its important established uses in the bag, towel, twine, cordage, and upholstery industries. Synthetic fibers, among which rayon was by far the most important, were beginning to offer serious competition in the manufacture of clothing. This was especially true abroad, where many countries were struggling to attain economic self-sufficiency and to reduce domestic unemployment. Wood pulp, the principal source of the cellulose which forms the basic material for rayon, was generally available to these countries at prices considerably below the cost of raw cotton and often without the expenditure of scarce foreign exchange. Nearly all of the other materials needed in rayon production were also available domestically to countries with well developed chemical industries.

Most of the foreign rayon producing countries had formerly been important cotton manufacturing countries that imported a large part of their raw cotton requirements. By 1940 they were producing rayon to the equivalent of well over four million bales of cotton, and the United States was producing an equivalent of over one million bales.¹²

Several rapid developments within the industry had advanced rayon to its position of formidable competitorship with cotton. When rayon first reached the market it was a weak, sleazy fiber, expensive to manufacture and limited in usefulness. By means of continuous chemical research its quality characteristics were steadily improved. After 1937 continuous filament yarn began to be supplemented with increasing quantities of rayon staple fiber (short lengths), which had greater versatility and which provided for the first time an alternative raw material for the great cotton-spinning industry. Shortly thereafter came the introduction of high-tenacity rayon, which had almost twice the strength of the ordinary viscose type used in clothing. This opened

11. See "Cotton Flunks a Test: Not Valuable in Asphalt Roads, but Other Uses Found to be Successful and Sound," *Business Week*, No. 547 (February 24, 1940), 20, 24. The other uses mentioned in this article, such as using cotton in sweeping compound and to make mats for curing concrete highways, were of minor significance.

12. U.S. Bureau of Agricultural Economics, *Statistics on Cotton and Related Data*, 387.

to rayon portions of the large industrial market where cotton had formerly been dominant because of its greater strength.

In terms of the quantity of lint consumed, the most important new use for cotton that had emerged in the twentieth century was in the manufacture of automobile tire cord and fabric. In experiments with high-tenacity rayon, it was discovered that the synthetic fiber offered superior resistance to the heat generated by flexing tires. Following the outbreak of World War II military specifications stimulated an increasing substitution of rayon for cotton in the manufacture of airplane, truck, and heavy-duty passenger car tires. Because of the great increase in total tire output, however, the full effect of this substitution on the market for cotton was not felt until after the war.

In addition to its quality characteristics, rayon has benefited from an increasingly favorable price relationship with cotton which also did not yield its greatest advantage until after the war, but which was already clearly evident as a trend during the thirties. From 1920 to 1938 the price of rayon declined greatly, so that even at the low price of cotton prevailing in the thirties the price differential was steadily being narrowed in favor of rayon. Ultimately (after 1943) the prices of cotton yarn and fiber were actually to exceed those of rayon on a pound for pound equivalent basis.

The Problem of Soil Deterioration

The attention which was focused on southern agriculture during the depression, when President Roosevelt referred to the South as "the Nation's No. 1 economic problem," exposed to public consciousness the cumulative effects of the decades of soil-eroding and soil-depleting practices which had taken place. Even in areas which had come under relatively recent cultivation, such as the Red Prairies of Texas, the erosive results of unrestricted row-crop cultivation were already visible in advanced form. The devastating effects of repeated droughts in what came to be known as the Dust Bowl of the Middle West and Southwest dramatized the general problem of soil deterioration and gave impetus to vigorous governmental attempts to cope with it.

The soil conservation program embraced in the farm legislation of the period stands out as a major achievement in the improvement of southern farming practices, both because of its comprehensive scope and because of the significant educational impact which it had within the region. Although in some of the areas of greatest depletion the

remedy came too late to be very effective and nothing short of a major adjustment in land use could have insured economic rehabilitation, the program succeeded in many parts of the region in bringing about a considerable transformation of basic soil practices in a remarkably short time. Methods of contour cultivation, terracing, strip cropping, rotation of intertilled crops with winter cover crops, soil amendments through the use of lime and other minerals, establishment of permanent pasture, and related practices became matters of general information and widespread adoption in one combination or another.

Since many of these practices required very little equipment or funds to institute, and since the imperative necessity to reduce cotton acreage was generally though reluctantly accepted, the relatively small soil conservation benefit payments were sufficient to induce large numbers of farmers to try some of the new methods, if only to make use of the released acreage. Of course, some farmers who preferred traditional methods of farming resisted the program, and many small farmers could not afford the minimal contribution demanded of the operator in order to qualify for the assistance of the Civilian Conservation Corps units or other soil conservation crews required for major improvement projects. Yet one had only to fly over the southeastern states by airplane toward the end of the decade to observe the magnitude of the change in farm lay-outs and cropping practices which had taken place. The utilization of soil conservation measures has continued into the postwar era, and represents one of the lasting benefits of the emergency program of the thirties.

An incidental effect of the soil conservation program was an increased acquaintance with the cultivation of new or unfamiliar soil-conserving crops such as soybeans, lespedeza, and kudzu, some of which turned out to have wartime importance as alternative cash crops. These uses tended to confirm in some farmers' minds the economic desirability of making permanent farm adjustments. In certain areas farmers acquired specialized equipment, such as sorghum and soybean combines, or utilized the new hay and forage crops for livestock production on their own farms. Some of these changes entailed major investments and thus represented a partial commitment to continue a new complement of farm enterprises. It would not be safe to conclude, however, that decisions to shift from or into cotton production throughout the Cotton Belt were no longer heavily governed by short-range estimations of alternative gains. The continuing sensitivity

of cotton acreage plantings to price changes testifies to the fact that the crop continued to hold primary consideration in the year-to-year decisions of most southern farmers.

Toward the latter part of the depression decade, by which time only partial recovery of southern agriculture had been achieved, officials in the Bureau of Agricultural Economics concluded that a permanent solution of the problems of the Cotton Belt could not be secured merely on the basis of soil conservation measures carried out by individual farmers or even by local Soil Conservation Districts. Large areas within the region were so clearly unfitted for continued row-crop cultivation that it was believed that major shifts in land utilization by subregions would have to be undertaken. A comprehensive program of land use planning directed toward the more efficient combination of farm resources was devised, and farmers were encouraged to discuss the proposals on the county level. The program provided that marginal and submarginal lands under inefficient cultivation would be returned to forestry or to livestock grazing. Where conditions permitted, crops of high nutritional value were to be substituted for southern staples. These changes would have necessitated substantial relocations of population and extensive training in new enterprises. When the broad implications of the program became clear, dissension arose between groups in the Department of Agriculture and in the land-grant colleges over the rate at which changes were to be encouraged and the methods to be employed. Congressional opposition to agricultural planning developed; and the coming of the war diverted attention from the urgency of a long-range program of agricultural reorganization. The program was thereupon discontinued.

The Farm Population Problem

The economic distress which characterized both urban and rural areas during the depression set in motion large unguided population movements, one effect of which was severely to complicate the problems of agricultural adjustment in the Cotton Belt. The governmental programs intended to assist the dislocated groups were in some respects contradictory in their objectives and thus often proved rather ineffective.

During the first half of the depression decade the long-term tendency of the American farm population to decline relative to urban population was reversed. Not only was the normally large natural increase in

farm population which had formerly found partial outlet in nonfarm employment dammed up, but there was a backwash of urban population to rural areas as unemployed industrial workers sought economic security through self-help on the land.

Because of the differential fertility of southern farm families, the problem of redundant population was particularly acute in the South. Although the crude birth rate in the eleven states comprising the Southeast fell more rapidly from 1917 to 1936 than the national rate, the number of births per thousand population in the Southeast remained substantially higher throughout the period, and in the *rural* Southeast the birth rate was highest of all. It must be observed that the significant additions to the farm population as far as employment during the depression was concerned were not the newly born but the maturing youth, many of whom were born during the population upsurge immediately following the first World War, when the birth rate in the Southeast was about 28 per 1,000 as compared with about 23 per 1,000 for the United States.¹³

Merely to have offset a rise through natural increase of the farm population in this region would have required an annual outflow of more than a quarter of a million people. Consequently farm population rose even in years when there was no net migration to farms. Rupert B. Vance has shown the significance of the interruption of normal movements when he states,

In the function that migration serves, the contrast between the 1920's and 1930's is startling. In the period 1920-30 a net movement of over 3 ¾ millions from southern farms meant a net loss of only 637,000 farm population. In the 1930's southern farms lost 2 ¼ millions by migration but gained over 1/3 million population. For only one year in these two decades, and that only in the depth of the depression, 1932, did the tide of net migration flow back to the southern farms. Yet so great was natural in-

13. For a careful analysis of the pattern of high fertility in the Southeast, see Rupert B. Vance, *All These People*, chaps. 6-8. Vance concludes that the Southeast appears to have a fertility differential in excess of what can be accounted for by measurable demographic and social characteristics such as specific age and sex composition, urban-rural distribution, and racial composition. He is of the opinion that the calculation of specific fertility by income status, for which the data were not available, might account for much of the difference, but he also attributes considerable influence to culturally derived sex attitudes apart from economic considerations. In this connection see the study of the attitudes of farm tenant mothers toward size of family conducted by Margaret Jarman Hagood: *Mothers of the South* (Chapel Hill: The University of North Carolina Press, 1939).

crease that the farms actually lost population only when out-migration exceeded 250,000, during 13 of the 22 years, 1920-41.¹⁴

An unfortunate aspect of the "Back to the Farm" movement was revealed by a study of population redistribution conducted under the direction of Carter Goodrich.¹⁵ This study concluded that the heaviest return migration was to the very areas of poor resources which had formerly given up population for lack of economic opportunity. These areas were generally suitable only for subsistence farming and were unlikely to afford a permanent adjustment of population to the location of adequate employment. In fact many of the migrants simply increased the relief rolls in rural counties.

Conditions within the cotton region contributed to an unusual displacement of population. The crop control program, which began with an almost indiscriminate reduction of cotton acreage during the plow-up year, had the unintended effect of throwing many tenants and farm laborers out of employment. Despite efforts of the government in succeeding years to provide against further displacement of tenants by stipulations inserted in the acreage reduction contracts, there was no effective enforcement of the contracts and little provision of any sort for workers employed as day hands. The method of assigning acreage allotments usually prevented displaced tenants from taking up cotton farming in new areas, and made no allowance for maturing farm youths who would normally have expected to enter farming as tenants or small operators.

Other factors contributing to the dislocation of farm population were the increased mechanization of farming, especially in the Southwest, and the abandonment of land in the "Dust Bowl" areas stricken by extreme drought. This complex set of circumstances underlay the restless movement of people which in the latter half of the decade resulted in a resumption of the drift to the cities and a portion of which eventuated in the heavy westward stream dramatized by John Steinbeck in his novel, *The Grapes of Wrath*.

Underlying the government's attempts to deal with the problem of displaced population and the "farm problem" in general during the early days of the New Deal administration was a basic conflict in

14. Vance, *All These People*, 131.

15. Carter Goodrich and others, *Migration and Economic Opportunity: The Report of the Study of Population Redistribution* (Philadelphia: University of Pennsylvania Press, 1936), chap. IX.

points of view. The issue was whether to encourage the "Back to the Farm" movement as a means of resettling substantial numbers of displaced farmers and unemployed urban workers on the land, or to encourage a resumption of the long-term trend of migration away from the farm, in the interest of economic efficiency in agriculture. Proponents of the former objective believed that the opportunities for family self-help as a means to economic security lay primarily on the farm, and they usually advocated a program of small-scale diversified farming in which economic self-sufficiency played a large part.¹⁶ They supported their proposals for a governmentally assisted agrarian movement with arguments stressing the desirability of widely diffused home ownership and the advantages of a rural environment for family life. They usually invoked the concept of the "agricultural ladder of progress," a scale of progressive tenure levels ranging from wage work to land ownership, the top rung of which was regarded as the desirable goal of all farm families and the requisite to successful farming.

Advocates of measures designed primarily to achieve agricultural recovery through economic efficiency in farming, on the other hand, believed that to encourage the "Back to the Farm" movement would only impede desirable changes in agricultural organization and create new problems of economic insecurity for the relocated families. They considered the primary task to be the raising of agricultural productivity to a level somewhat comparable to industrial productivity, in order to make possible an increase in the income level of farmers engaged in commercial agriculture. They held that the problem of dislocated population was not peculiar to agriculture, but that it was related to the general problem of national economic recovery; and that improved technology in farming demanded units of larger average size and a continuation of the siphoning of excess population from the farms. This group tended to minimize the importance of land ownership as an end in itself, arguing that encumbered ownership of a small holding (such as the "forty acres and a mule" often referred to as a southern standard) was generally less desirable than the oppor-

16. Representative of a large literature expressing this point of view are Charles S. Johnson, Edwin R. Embree, and W. W. Alexander, *The Collapse of Cotton Tenancy* (Chapel Hill: The University of North Carolina Press, 1935); and O. E. Baker, Ralph Borsodi, and M. L. Wilson, *Agriculture in Modern Life* (New York: Harper and Bros., 1939).

tunity to rent or manage a unit of sufficient size to be adapted to the use of modern equipment.¹⁷ They therefore emphasized the need for more adequate forms of production credit, marketing facilities, and other aids to commercial farming.

The views here contrasted were not necessarily in conflict at all points. There were of course numerous variations in the positions taken by individuals, and attempts were made to modify the extreme divergencies of opinion in order to achieve both of the major objectives: population relocation and economically efficient farming. But the alternative aims continued to engender wide differences in emphasis for policy formation. In light of the acute human distress and the stagnation in the industrial sector of the economy which existed at the time, it is not surprising that the agrarian view tended to prevail in the early attempts to deal with the population displacement problem.

After fragmentary efforts by several federal agencies, the Resettlement Administration was organized in 1935 to help displaced farm families return to the land through the establishment of subsistence homesteads and the provision of rehabilitation loans and grants. Some of the homesteads established were scattered single farms; others were organized on blocks of land as cooperatively managed or centrally supervised communities. Group projects were most common in the South and Southwest, which were the areas of greatest displacement and at the same time the areas where the old plantation type of landholding lent itself to communal settlement and operation.¹⁸

Funds for financing the new projects were limited, and many of the homesteads suffered the handicaps of inadequate equipment and of location on submarginal land. The families relocated were in many cases incapable of successful farming, for lack of training, habituation to poor methods, or poor health. Markets for farm products remained depressed for a number of years, and the disparities of relative farm efficiency within agriculture subjected the new enterprises to intense competition.

A variety of circumstances therefore contributed to the failure of

17. For a recent statement of this view, based on farm cost studies in Iowa and Illinois, see Theodore W. Schultz, *Production and Welfare of Agriculture* (New York: The Macmillan Co., 1949), 129-33.

18. Cf. Rexford G. Tugwell, "Report on the Objectives, Accomplishments, and Effects of the Resettlement Administration Program," *Resettlement Administration Program*, Senate Document No. 213, 74th Congress, 2nd Session, May 12, 1936 (Washington: Government Printing Office, 1936).

the resettlement program, although it did serve as a limited relief measure.¹⁹ It should be noted, however, that the program was not intended simply as an emergency relief measure, but as a long-range plan for agricultural and population adjustment. Even if it had been successful in its aims, it would no doubt have fostered a subsistence type of farming which could have afforded only a very low standard of living to the affected part of the farm population. There appears to have been considerable confusion in the administration of the program concerning the relative economic advantages of diversification by farm and diversification within a region. Agronomists tend to agree that it is often economically feasible for farmers in a given area (especially if it is undergoing urban and industrial development) to diversify the output of the area by specializing individually in the production of a single commercial crop or in a limited combination of complementary enterprises. Yet if each farmer tries to diversify the output of his individual farm to the degree implied by the goal of approximating self-sufficiency, he is likely to operate at very low levels of efficiency and income. The confusion of these distinctly different modes of farm organization under the common label "diversification" persists in current popular discussion of the problems of southern agriculture. Specialization by farm (though not necessarily in one staple crop) and diversification by region appear to be compatible in the South with the requirements of production and consumption under commercial conditions. On the other hand, diversification by farm with the aim of family self-sufficiency belongs to another era.

Notwithstanding the severe criticism to which it was subjected by

19. The unhappy story of the failure of the resettlement program as a long-range plan for rural rehabilitation of displaced farm families can be discerned in the detailed report submitted by the Farm Security Administration, the successor agency (later the Farmers Home Administration), in Hearings before the Select Committee of the House Committee on Agriculture to Investigate the Activities of the Farm Security Administration, 78th Congress, 1st Session, 1943, Part 3 (Washington: Government Printing Office, 1944). In characterizing the program as a failure, it must be acknowledged that the magnitude of the rural relief problem confronting the Administration in the thirties was overwhelming, and that there was intense hostility on the part of powerful interest groups at all stages of the government's attempts to cope with this problem. In a limited way the resettlement program mitigated the severity of the times for a portion of the distressed farm population by providing subsistence, better housing, and medical benefits. At the same time, however, it imposed hopelessly large debts upon most of those assisted, and supplied them with an inadequate economic base by means of which to effect repayment. Though well intentioned, the program tended to leave families as insecure as before and ultimately to require the liquidation of the projects.

groups who opposed any attempt to alter the basic institutional pattern in southern agriculture, the Farm Security Administration, which assumed responsibility for aiding low-income farmers in 1937, was able over a period of time to improve the effectiveness of the rehabilitation program. This was partly the result of increased administrative experience and the redefinition of objectives, but was also greatly facilitated by general economic recovery and the increased demand of the war. In general, however, the farmers assisted by this program remained in the low income group, heavily reliant on "live-at-home" farming. The greater part of F.S.A. assistance was administered in the form of rehabilitation loans and grants in which supervised planning and expenditure were important elements. The delinquency rate on rehabilitation loans fell rapidly with improved conditions. For the fiscal year 1937 principal payments in relation to matured principal were 47 per cent; by 1940 they had reached 76 per cent, and by 1943, 93 per cent.²⁰

The Farm Security Administration was also placed in charge of the Tenant Purchase program authorized by the Bankhead-Jones Farm Tenant Act of 1937. This act provided for the extension of long-term credit at low interest rates (40-year loans at 3 per cent, deferrable in poor years) to enable selected tenants, sharecroppers, and farm laborers to buy their own farms. The 1935 Census of Agriculture had revealed the highest tenancy ratio recorded in the history of the country, and the report of The President's Committee on Farm Tenancy called particular attention to the rapid increases in tenancy which had been taking place in the West South Central states, as well as in the rest of the South.²¹ For the South as a whole the proportion of farms operated by tenants (including sharecroppers) had risen from 50 per cent, reported in both 1910 and 1920, to 56 per cent in 1930, followed by a decline to 54 per cent in 1935. The decline is accounted for in part by a sharp increase from 1930 to 1935 in the total number of farms, a large proportion of which were small subsistence or part-time farming units established by persons unable to find employment elsewhere; and in part by a decrease of about 10 per cent in the number of Negro tenants, many of whom reverted to the status of farm

20. U.S. House Select Committee to Investigate the Activities of the Farm Security Administration, *Hearings* cited, Part 3, 993.

21. U.S. President's Committee on Farm Tenancy, *Farm Tenancy* (Washington: Government Printing Office, 1937), 35-39, 98-99.

laborers. Actually there was an absolute increase of about 41,000 tenant farmers in the South from 1930 to 1935.

In the West South Central states the tenancy ratio rose from 53 per cent in 1910 and 1920 to 62 per cent in 1930; and then declined to 60 per cent in 1935. In some parts of the South, particularly in the alluvial lands along the lower Mississippi River, over 80 per cent of the farmers were tenants in 1935, and extensive areas within the Cotton Belt had tenancy ratios of from 60 to 79 per cent.

The Tenant Purchase program was inadequate to finance more than a small proportion of the total number of aspiring farm owners among such large numbers of tenants (in most years there were more than twenty applications for each loan that could be granted); but by 1943 the repayment ratios were sufficiently high to indicate that a very large proportion of borrowers had been able to provide evidence of the economic justification of their loans.²²

The outcome of the dislocations brought about by the depression and the period of incomplete recovery which followed was a vast reshuffling of population in which long-term trends reasserted themselves. Farms in the Census South are estimated to have lost 2,275,000 people through migration from 1930 to 1940.²³ The direction of movement was toward cities within the region and toward chiefly urban areas in the Western and North Central states. Figure 3 shows that the state with the greatest rate of loss of farm population in the South was Oklahoma, followed by Texas, Georgia, and South Carolina. Oklahoma, Texas, Arkansas, and Louisiana contributed about 180,000 migrants, from both farm and nonfarm areas, to California during the five years from 1935 to 1940, and of these about 95,000 originated in Oklahoma alone. About 35 per cent of the migrants from Oklahoma came from farms, but only 13 per cent were able to settle on farms in California.²⁴

It should also be noted that in the Southwest a large number of seasonal farm workers of Mexican origin were in effect ejected from the cotton labor force when they became destitute and had to be repatriated by the Mexican government during the thirties. Since many

22. U.S. House Select Committee to Investigate the Activities of the Farm Security Administration, Hearings cited, Part 3, 1016-17.

23. *Agricultural Statistics, 1942*, 644-45.

24. Henry S. Shryock, Jr., and Hope Tisdale Eldridge, "Internal Migration in Peace and War," *American Sociological Review*, 12, No. 1 (February, 1947), 29-31.

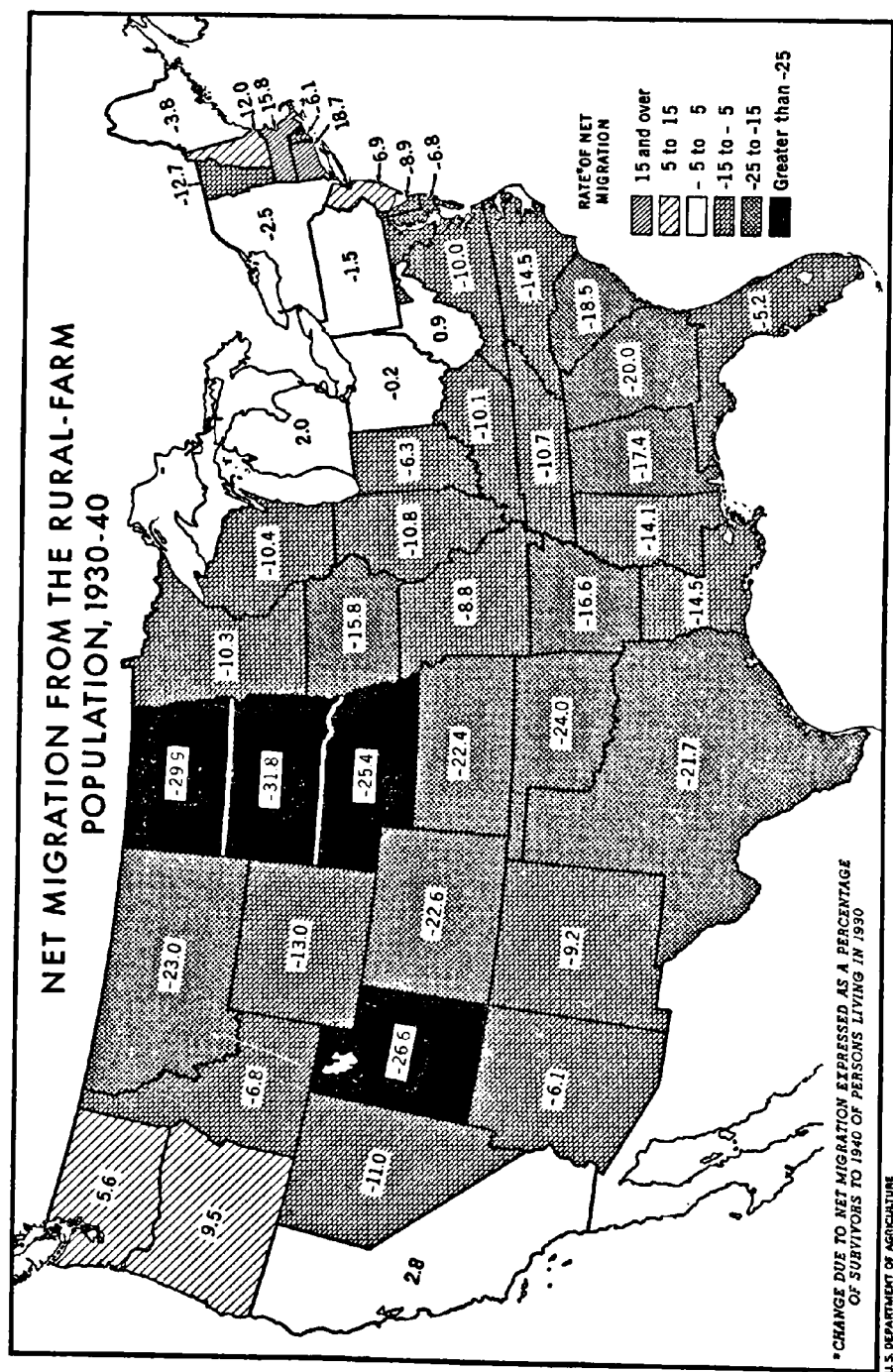


FIGURE 3

of these workers entered the country illegally under the loose operation of the immigration laws, no adequate figures exist on the number involved, but it is roughly estimated that a half million Mexican nationals returned to Mexico during the decade.²⁵

As it became evident during the latter part of the depression decade that a large number of farmers could not be resettled on the land and, in the absence of alternative opportunities, would be reduced to casual farm labor, the Farm Security Administration undertook to establish migratory labor camps for them with improved standards of housing and sanitation, and in cooperation with the U.S. Employment Service to provide information on employment opportunities in the specialty crops. With the improvement in general employment conditions and the development of seasonal farm labor scarcities during the war this activity became increasingly valued by employers, and the agency was authorized to recruit migratory labor (including contract labor from Mexico and the British West Indies) and to organize their transportation and placement.

Inefficiencies in Farm Management and Adjustment

Many of the aspects of agricultural inefficiency which emerged in intensified form during the Great Depression have already been alluded to above: the continued production of a staple crop which was manifestly in oversupply, the depletion of resources, and the inappropriate man-land ratio in most parts of the South. To emphasize these aspects exclusively, however, is to overlook the considerable number of farmers in the Cotton Belt who had the capacity, which they had demonstrated in earlier years, to farm with reasonable commercial efficiency using the resources at their disposal. The circumstance which most severely afflicted this group as the depression deepened was the virtual collapse of the local credit system, the chief source of operating funds. The extensive failure of banks and credit merchants and the general contraction of lending activities by surviving firms severely reduced the supply of short-term and intermediate credit on which many farmers had regularly depended to balance their year-to-year farming operations and to improve their equipment.

The local credit system, as we have seen, had always had its gross

25. U.S. President's Commission on Migratory Labor, *Migratory Labor in American Agriculture* (Washington: Government Printing Office, 1951), 37.

limitations. One of these was the traditional disparity, not wholly justified by differences in risk and administrative costs, between interest rates near the financial centers and those in outlying rural areas. As recently as 1938 the National Emergency Council reported that the weighted average interest rate charged by banks in twenty-seven large southern and western cities in June of that year was 4.1 per cent, while for New York City it was only 2.4 per cent, and for eight other northern and eastern cities, 3.4 per cent. State banks outside the Federal Reserve System were charging average interest rates in the South ranging from 6.5 per cent in Virginia to 10.4 per cent in Texas and 11.5 per cent in Oklahoma. In the New England and Middle Atlantic states the average rate for similar banks was 5.8 per cent, and in the Mountain states 8.5 per cent, which was lower than for five of the southern states.²⁶

The Farm Credit Act of 1933 provided for a system of Production Credit Associations whose function was to fulfill the need for one- to three-year loans for current operating expenses. While all too commonly following the traditional practice of securing loans only with crop and livestock liens, the new institution introduced several innovations which increased the availability of this type of credit to farmers. Local loan agencies were organized in the form of cooperative associations controlled by their own members, but initially financed and closely supervised by the twelve regional production credit corporations of the Farm Credit Administration. It was anticipated that through a plan of farmer stock purchase the associations would ultimately become locally owned and capitalized, permitting the government to withdraw its financial support. Most associations were able to set their interest charges lower than those of local banks, for which they soon began to provide active competition. A budgetary loan plan was introduced under which each loan was disbursed only as needed and interest computed only on the length of time each loan dollar was outstanding. These associations have been highly successful, the national losses on loans having been only one-tenth of one per cent of

26. U.S. National Emergency Council, *Report on Economic Conditions of the South* (Washington: Government Printing Office, 1938), 50. The basis of comparability of these figures is not made clear in the report, but the general conclusion that lack of competition among country banks and a tradition of high rural interest rates resulted in differential rates for essentially similar types of credit is borne out by other studies. Cf. Calvin B. Hoover and B. U. Ratchford, *Economic Resources and Policies of the South* (New York: The Macmillan Co., 1951), 178-80.

the total cash advances since the organization of the system in 1933.²⁷

There has also been substantial progress in the acquisition of farmer ownership of the associations, most of which was achieved during and following World War II. Of a national total of 503 associations, 56 were completely member-owned by July 1, 1949, and 259 others were approaching this condition. Seventeen of the wholly member-owned associations were in the South, of which fifteen were in Texas. In large portions of the Southeast, however, where small farms predominate and the average size of loan is small, farmer ownership of the credit associations has apparently not proved feasible. This is an indication that in the older parts of the South the savings of farmers generated even under the improved income conditions of the war and postwar period were inadequate to sustain a system of cooperative self-financing as a major source of operating credit.

Thus, much as operating credit facilities were improved during the decade of the thirties, certain inadequacies in the structure and operation of governmental and private credit agencies remained.²⁸ Many prospective borrowers fell between the respective loan eligibility requirements of the Farm Security Administration and those of the Production Credit Associations, owing to the vastly differing bases upon which these agencies selected their clients. F.S.A. clients were generally taken from relief rolls and had to meet limited means tests to qualify for rehabilitation loans. P.C.A. borrowers, on the other hand, had to demonstrate a high probability of loan repayment according to conventional banking standards, which meant a perpetuation of the crop lien device. Successful commercial farmers with large established enterprises therefore had little difficulty in qualifying for P.C.A. loans and their favorable rates, but operators of small and moderate-sized

27. U.S. Farm Credit Administration, *Annual Report of the Farm Credit Administration, 1948-49* (Washington: U.S.D.A., 1950), 8.

28. Other forms of farm credit afforded by the government during this period, such as the emergency seed and feed loans, the nominal marketing loans of the Commodity Credit Corporation, the capital supplied to cooperatives and other private agencies by the Banks for Cooperatives and the Intermediate Credit Banks, and the mortgage loans of the Federal Land Banks and Land Commissioners, are not discussed here since they have only an indirect bearing on the adequacy of operating credit; but they are taken into account in making this statement. The comments which follow are based in part on an unpublished study of the adequacy of federal farm credit policies by Professor C. A. Wiley of the University of Texas, and in part on a likewise unpublished study of the administration of farm credit programs conducted by the Division of Program Surveys of the Bureau of Agricultural Economics in 1941-42.

farms seeking to obtain enough capital to make needed adjustments in their plan of operations sometimes found it impossible to provide adequate security in the initial stages of the changeover.

This condition was somewhat alleviated by the liberalization of general credit conditions and special governmental assistance during World War II, but the persistence of the crop lien tradition as the principle governing the extension of credit in the South is still a retarding factor in the accomplishment of desirable land-use adjustments. According to the statement of a special committee investigating the possibility of achieving an efficient agriculture in the South:

Credit for financing durable production requirements such as breeding herd increases, water management fixtures, livestock equipment and facilities, pasture improvement, cropland development and improvement, and timber management will constitute a vitally important need in a general shift to efficient farming. . . . It is in this field of credit that new problems arise. Some such loans could not be secured by chattels on mortgageable items since they would be made for developments which become integral parts of the farm and have little value if torn out for independent resale. Loans for soil and pasture improvement and for timber farming are relatively new. Most credit institutions do not have established policies concerning such credit, and many farmers fail to appreciate the way such capital can be used to facilitate improvements in farming.

. . . A major expansion in use of credit in itself would require a re-examination of policies and procedures for extending such credit. In addition to this problem, however, credit expansion needed in the South involves changes in the basis for such credit and the development of new types of credit. The dominant importance of the cotton crop lien as the security for most credit other than long-term mortgage credit will disappear.

. . . Managerial capacity will be a primary factor in determining how much and what type of credit to extend. This is particularly true since the purpose of credit will be to make possible changes in farm organization and methods of farming.²⁹

Attitudes Toward Mechanization

To the catalog of unstabilizing forces which the cotton economy experienced during the great depression, and which led many observers

29. "Adjustments Toward Efficient Agriculture in the South," *Study of Agricultural and Economic Problems of the Cotton Belt*, Hearings before the Special Subcommittee on Cotton of the Committee on Agriculture, House of Representatives, 80th Congress, 1st Session, Part I, July 7 and 8, 1947 (Washington: Government Printing Office, 1947), 52.

to regard cotton growing as a permanently declining industry, we should add one more which would ordinarily be regarded as an element of economic progress. This was advancing farm technology.

From the point of view of the individual operator the introduction of new machinery offered the possibility of rationalizing his operations, reducing his costs, and enabling him to remain in farming. For the community of cotton farmers as a whole, however—especially in those areas where mechanization had proceeded most rapidly, as in the western cotton region—it contributed to the displacement of population, to the consolidation of farms and the concentration of land ownership, and to widening disparities in farm incomes. In short, because of its increased capital requirements, mechanized farming intensified the conditions of competition within the industry and added to the disadvantages of those who did not possess the necessary funds, land, experience, or initiative to utilize the new methods.

There was therefore a good deal of resistance to the introduction of the tractor and other machines at this time, although, as we shall see, the process of partial mechanization went on at a remarkably rapid rate in the areas most favorable to it. A fuller description of this process is deferred to Chapter 8. It is sufficient to note that in most parts of the Cotton Belt before World War II the coming of mechanized farming, rather than being widely welcomed, was anticipated with considerable dread of its economic and social consequences. Nowhere is this anxiety more clearly exemplified than in the efforts made by John D. and Mack Rust to prevent or mitigate the social distress which they foresaw in the uncontrolled introduction of their cotton picking machine.³⁰ During this period it was not uncommon for warnings of the following sort to emanate from sociologists, government officials, and farm leaders:

There are 8 to 9 million individuals in nearly 2 million tenant families in the 10 Cotton States. If mechanization proceeded rapidly without substantial change in the present cotton acreage, it has been estimated that at least one-fourth of these tenant families to three-fourths of these would no longer be needed. . . .

Would they pour into the North and seek employment in industry? If so, what would be the effect on organized labor, wages, and standards of living among both skilled and unskilled workers? Many of the people

30. See Chapter 6.

from the rural South have had almost no experience with industrial discipline and complicated machinery; could they be trained to useful and self-supporting employment? ³¹

Yet there was important developmental work in the field of farm technology going on during this period and some farm operators were actively experimenting with methods and machines which they hoped would result in the total mechanization of cotton growing. Even if cotton were to remain a distress industry, there was an advantage to be gained in cutting costs competitively; and although the prospects for total mechanization were currently unfavorable, some farmers were by now so "machine-conscious" that they felt it was only a matter of time until equipment was perfected that would greatly reduce the costs of production and simultaneously reduce the dependence on a hand labor force.

31. Roman L. Horne, "Cotton Pickers," *Technological Trends and National Policy*, Report of the Subcommittee on Technology to the National Resources Committee (Washington: Government Printing Office, 1937), 142-43.

CHAPTER 4

World War II Shakes Up the Enterprise

THE ADVENT OF World War II altered many of the depressing conditions that had characterized southern agriculture during the thirties, and that many people had come to regard as virtually permanent aspects of the cotton economy. The war accelerated long-desired trends in population movement, mechanization, and land use adjustment. Then, too, in the immediate postwar years, the domestic carry-over was severely reduced as the result of an unprecedented peacetime demand for cotton goods coupled with two years of low production. Consequently the optimistic feeling arose in some quarters that what economic planning had not been permitted to accomplish, the war might fortuitously have brought about.

This optimism tended to be offset by a number of developments whose impact came somewhat later. These included the rapid return of population to the farms; the resumption of larger cotton plantings; the decline in domestic cotton consumption in 1948 followed by a return of the surplus and the reinstitution of marketing quotas and acreage allotments; the worsening competitive position of cotton relative to foreign growths and to rayon; and the general uncertainty about the course of world events. Once more doubts arose as to the future of the cotton enterprise. In large measure the long-term prospect for cotton seemed to hinge upon the feasibility of technological reorganization of the enterprise, if not of southern agriculture in general.

In continuing the historical review of basic trends within the American cotton economy, the following discussion will concentrate on the effect of the war on producers' decisions and on the long run outlook for the cotton enterprise. The period was an exceedingly disturbing one in the uncertainties which it created for cotton growers, but the general "shaking up" received by the enterprise, as we shall see, brought with it certain benefits.

One of the important social aspects of the war was the setting in motion of a vast population movement which had significant—but by no means obvious—effects on the farm labor supply. Although this movement unquestionably affected producers' decisions, it was extremely complex, and will therefore be discussed separately, in Chapter 9. Another aspect of economic development during this period was the process of technological change, which in portions of the South was already well under way and gaining acceleration. A description of this process will also have to be postponed, since when one attempts to distinguish the pattern of cause and effect, one is forced to conclude that World War II registered such a large, independent influence on the cotton economy that it must be regarded as the dominant factor affecting events during the decade. According to this interpretation, the war created the compelling climate within which the technological process pursued its course, and the principal set of influences to which for a time that process responded. In most parts of the region mechanization began to be a powerful independent influence only after the war.

EFFECTS ON CONSUMPTION, PRODUCTION, AND FARM INCOMES

As in the case of the first World War, the initial effect on cotton of the outbreak of hostilities in Europe in the fall of 1939 was unfavorable. By mid-June of 1940 the greater part of the continental market was inaccessible, and cotton stocks began to pile up in most exporting countries. American exports, which had reached six and a half million bales in 1939 during the period of war preparation, fell off to little more than one million bales the following year (Figure 4). This country's military allies found it hard to buy American cotton because of the need to conserve dollar exchange for more urgently needed supplies, because of shipping difficulties, and because of the tendency for

UNITED STATES PRODUCTION AND IMPORTS, CONSUMPTION, AND EXPORTS, OF COTTON: Years ending with July 1915 - 1955

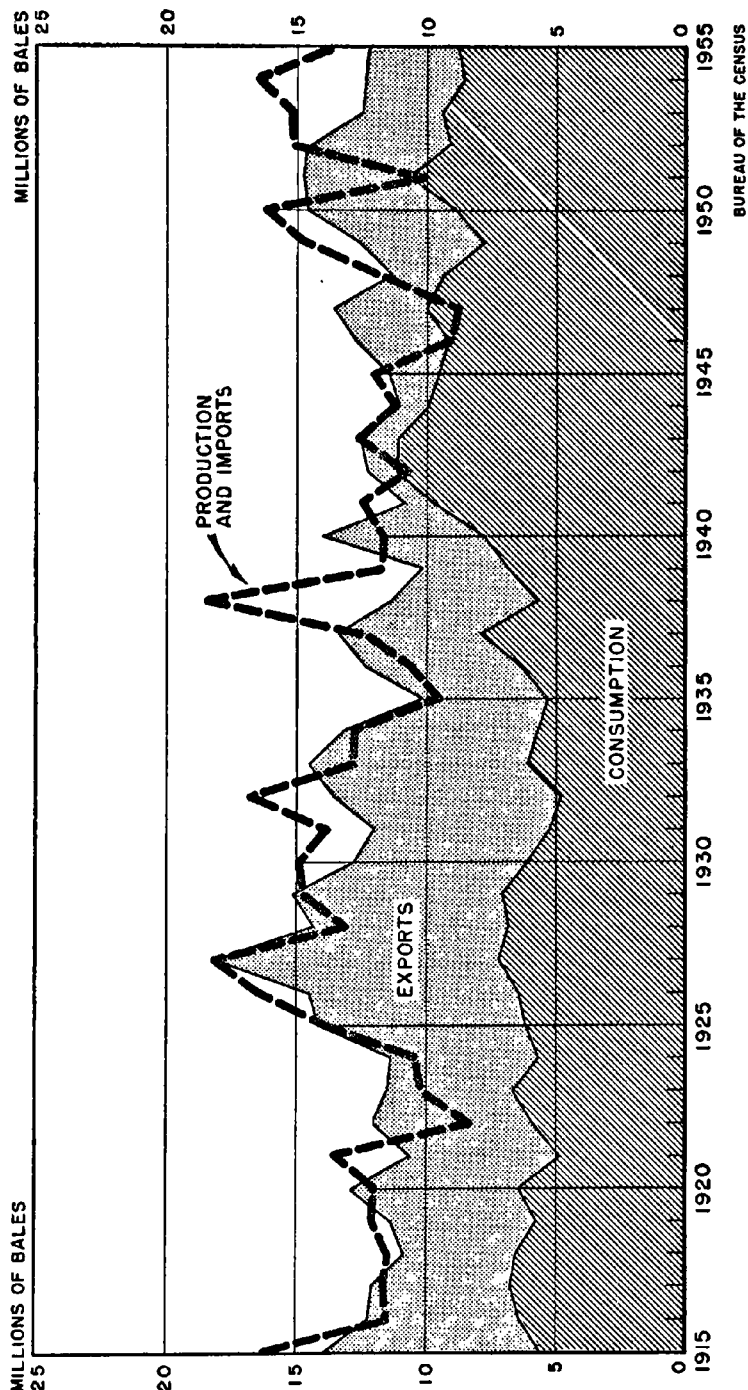


FIGURE 4

American cotton to be overpriced in the world market as a result of the domestic price-support program. The export payment (subsidy) plan, intended at the outset as a temporary expedient to clear excess American stocks, was retained and amplified during the war to subsidize Canadian purchases. It was also used to make cotton available on favorable terms to countries eligible for lend-lease aid and to South American buyers. Notwithstanding these price concessions, other requirements took priority and exports of raw cotton from the United States remained near the low level of 1940 throughout the remainder of the war.

Nevertheless, the extreme decline in the export market was more than offset by a tremendous wartime expansion in consumption of cotton by American mills, which were well supplied with military and civilian orders. Domestic consumption of American cotton in 1941 and 1942 reached eleven million bales, as compared with an average annual consumption rate of about six million bales during 1929-1938, and it approached the level of world consumption of American growths during prewar years. The limits of mill capacity and the tightness of the industrial labor supply were the only important restraining factors on domestic cotton consumption during the peak war years.

The record rate of wartime consumption in the United States was accompanied by greatly expanded mill consumption in other cotton-producing countries, such as Brazil, Egypt, and Mexico, and by a reduction of cotton acreage in favor of food production in all of the larger and many of the smaller cotton-producing countries. Yet, surprisingly enough, so great was output that the world cotton surplus increased, rather than declined. At the beginning of the 1945 crop season the world carry-over reached twenty-six and a half million bales, the highest level of all time. This was equivalent to about one year's normal world growth and consumption. Of the total, 45 per cent was American cotton.

When the United States entered the war, the large amount of unclaimed cotton on which price support loans had been extended by the Commodity Credit Corporation constituted, in effect, a government stockpile from which current farm output could be supplemented to meet the unusual domestic mill demand. It was argued by some that the principle of the Ever-Normal Granary (as applied to cotton) whereby surpluses in some years would be stored to make up scarcities in other years, had justified itself. However, although enough

cotton was fed into the production stream in this way to make it possible for the Commodity Credit Corporation eventually to show a net gain on the purchase-and-sale transaction, the domestic carry-over never fell below ten and one-half million bales during the entire war (see Figure 2).

Behind these figures lies the story, critically recounted by Professor Bela Gold in *Wartime Economic Planning in Agriculture*,¹ of the failure to accomplish the major transition from cotton to food growing which was the announced policy of the Department of Agriculture and which would seem to have been warranted, if it could have been achieved, by the pressing demand for increased high-nutrient food-stuffs as compared with the relatively stable total consumption rate for cotton. The safety factor represented by the large annual carry-over of cotton indicates that at no time during the war did the danger of a serious shortage of ordinary grades of short staple cotton exist, although there was a special demand for a relatively small quantity of long-staple American Egyptian cotton, most of which was grown in newly opened areas in Arizona. A relatively greater demand for higher grades and longer staple lengths of upland cotton, which tended to increase the efficiency of combing and spinning operations, also arose. This required no net increase in production, but merely a substitution of varieties grown.

Although cotton acreage in cultivation declined almost continuously from year to year during the war, falling from twenty-five million acres in 1940 to seventeen and a half million acres in 1945, yields were exceptionally high in most years and average annual production for 1940-1944 was about what it had been in 1938 and 1939 (see Figure 1). (Adverse weather, in combination with the reduced acreage, rendered the 1945 crop unusually small.) The continued large production of short-staple cotton, regarded by the Department of Agriculture as an inessential war crop, was undoubtedly fostered by the high degree of inconsistency in governmental policies during this period, especially with regard to price supports.

On the one hand the Department waged a strongly publicized campaign to encourage the production of those farm products designated as "essential war crops" by establishing a system of production goals which were in turn broken down by states, counties, and localities.

1. Bela Gold, *Wartime Economic Planning in Agriculture: A Study in the Allocation of Resources* (New York: Columbia University Press, 1949).

These goals were in most cases increased from year to year. Unusual price inducements were offered as the result of Congressional enactments which broadened the number of crops subject to price supports and which guaranteed minimum prices of at least 90 per cent of parity for two years after the official termination of the war. It was believed that these price guarantees were needed to allow time for a postwar readjustment of farming operations since, on the basis of World War I experience, it was expected that the world market for agricultural products would collapse soon after the end of the war. For a limited time in 1943 the Regional Agricultural Credit Corporation made available a special type of limited-liability loan to finance the production of war crops, with the specific exclusion of short-staple cotton.²

On the other hand, at the insistence of southern farm interests, who argued for "equality of treatment," short-staple cotton was afforded the same degree of parity price support as other, more essential crops, and the agricultural mobilization authorities were thereby denied the effective means of employing differential price incentives to induce shifts in crops raised. Since farmers preferred to continue growing the crop they were familiar with, the assurance of a firm price support at near-parity levels unquestionably weighed heavily with many against taking the trouble, increased investment, and risk involved in going into new farm enterprises. Moreover, the Department of Agriculture's production goals program appeared at times to stress the desirability of a general increase in *all* farm products, rather than a relatively greater increase in selected ones. Thus, although farmers were repeatedly urged to grow less short-staple cotton and more of other crops, the official production goal for cotton was set higher than the actual acreage of the preceding year for every year of the war except 1943, and even in that year the Secretary of Agriculture increased the cotton acreage allotments by 10 per cent before planting time and later removed all marketing quotas on the crop. Acreage controls on cotton plantings were not resumed until 1950.

The price of cotton began to rise rapidly as soon as it became evi-

2. Advances were made to finance the actual cash outlay, including marketing and processing costs, involved in producing specified crops (mostly fresh vegetables) with liability for repayment restricted to actual returns from the crop, provided that the local War Board certified that the crop had been diligently cared for. (U.S. Farm Credit Administration, *Food Production and Financing Bulletin F-2*, Washington: U.S.D.A., April 5, 1943.) This type of loan was discontinued the following year upon Congressional complaint that it had been too liberal in its terms.

dent that the United States would enter the war. The average price received by farmers rose by 72 per cent during 1941, from 9.9 cents to 17.0 cents, and continued to rise more moderately but persistently until the end of the war, by which time it had reached 22.5 cents.³ For this increase several factors were responsible. The mandatory loan rate on cotton was set at 85 per cent of parity by Congress in May, 1941, and increased progressively to 92.5 per cent by 1944. A smaller-than-average crop in 1941, together with a general rise in commodity prices resulting from defense orders, stimulated the initial price rise, and heavy domestic consumption sustained prices near the rising parity level throughout the war. Gross farm income from cotton and cottonseed exceeded one billion dollars in 1941 for the first time since 1929, and by 1944 it was over a billion and a half.

Since costs had not risen nearly so rapidly as prices during the first three years of the war, net income to the farm operator and his family rose markedly.⁴ Another factor tending to increase the per capita income of cotton farmers was the considerable reduction in the southern farm population at the same time. This meant an increase in the average share of farm income going to those persons remaining in farming. The greatly improved income position of southern farmers also resulted in an increased rate of debt repayment and an accumulation of liquid funds with which to buy machinery and make other farm improvements. According to a study by the Bureau of Agricultural Economics, average realized net income of farm operators per farm went up about two and one-half times from 1939 to 1943 in the South Atlantic and South Central divisions.⁵

Even so, the absolute return per southern farm remained low enough to compare unfavorably with incomes in other farming areas and in industrial employment. Realized net income per farm in the South Atlantic states in 1943 was \$1,497, and in the South Central states,

3. This was not the peak, which was reached during the general postwar inflationary period of the following year, at 32.6 cents.

4. According to an unpublished analysis by the Division of Research of the Office of Price Administration, based on Department of Agriculture data, cotton prices rose 102 per cent from January 1, 1941, to July 1, 1943, while costs of production based on prices paid for production expenses, interest, taxes, and hired labor on *specialized farms* rose only 36 per cent. (Cited by Gold, *Wartime Economic Planning*, 393).

5. U.S. Bureau of Agricultural Economics, *Income Parity for Agriculture*, Part VI, Section 1 (Washington: U.S.D.A., October, 1945), 13. Government payments are included as farm income. The data are not broken down for the far western cotton areas.

\$1,479; as compared with \$1,704 in the North Atlantic, \$2,498 in the East North Central, \$3,192 in the West North Central, and \$4,027 in the Western states. In the following year southern incomes rose more rapidly than those in other regions, but the averages remained lower than for all others; \$1,830 per farm for the South Atlantic, and \$1,602 for the South Central states. In Alabama the average remained as low as \$1,251.

EFFECTS ON LAND-USE ADJUSTMENTS

In contrast with farming areas in other parts of the United States, most parts of the Cotton Belt experienced a decline in the total acreage of croplands harvested during the war.⁶ A considerable part of the decline was due to a reduction in cotton acreage which, as we have seen, took place in every year but 1942. The principal reasons for the reduction were the heavy exodus of population from southern farms during the war years, the decreasing relative profitability of cotton as costs began to rise compared to prices received during the last two years of the war, unfavorable weather at seeding time in 1944 and 1945, and increasing familiarity with favorable alternatives requiring less labor. In some cases as the labor situation tightened, the acreage taken out of cotton was simply permitted to lie idle, particularly where the land was so poor that entire farms were abandoned by their former operators. By 1944 idle cropland in the Southeast had increased 38 per cent over 1943, and the following year it increased 17 per cent further, so that by 1945 the nearly six million idle acres in the region accounted for almost one-fifth of its total cropland.⁷

On the other hand, many farmers tried out new enterprises, some of which replaced cotton and some of which were simply added as supplementary sources of income utilizing the resources of farms more intensively. The establishment of Army camps and industrial enterprises in scattered areas of the South and Southwest vastly increased the local market outlets for dairy and poultry products, for some fruits and vegetables, and for pork and beef, at the same time that they provided alternative employment opportunities for large numbers of un-

6. The only states which constituted exceptions were Oklahoma, Texas, New Mexico, Arizona, and California, and even these showed a decline in most of the cotton areas. U.S. Department of Agriculture, *Agricultural Statistics*, 1950, 568.

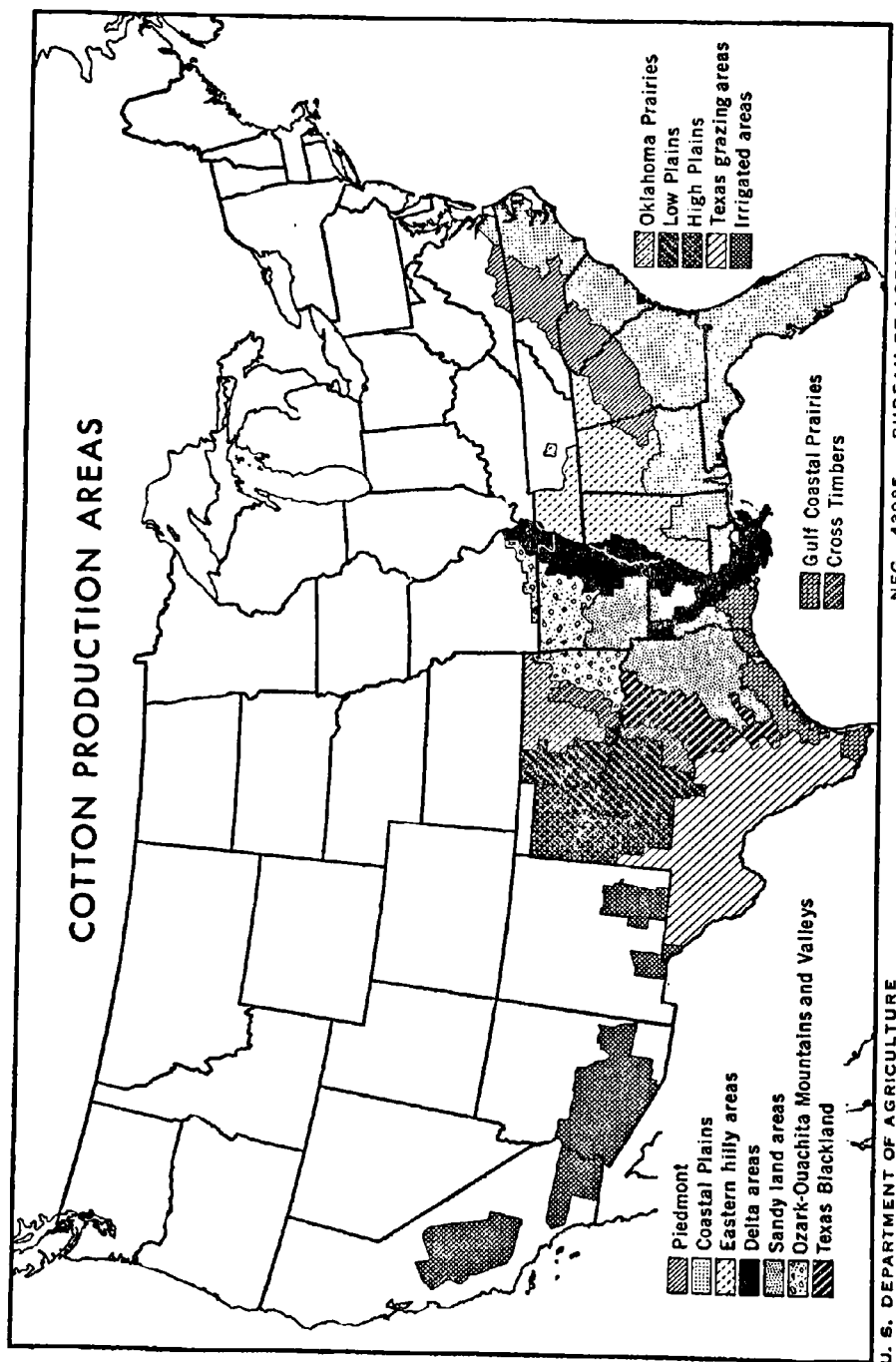
7. James C. Downing, "Regional Production Roundup: Southeast," *Agricultural Situation*, 29, No. 12 (December, 1945), 11.

deremployed farm workers. In addition there was an unusual wartime demand for oilseed products and livestock feedstuffs. The new enterprises undertaken by farm operators during this period of rapidly changing conditions varied greatly by type-of-farming area and were influenced by the fact that some local areas experienced a drain of cotton labor much earlier than others. Some typical adjustments will be described in order to illustrate the great variety of possible responses to the new conditions. (See Figure 5 for location of the cotton areas referred to in the succeeding discussion.)

In the light sandy soils of Georgia and Alabama the principal change was a heavy expansion in peanut acreage. Because this was one of the areas most abundantly supplied with labor and unutilized land, much of the increased planting amounted to "taking up the slack" in farming as it had been conducted during earlier years. The initial expansion tended to be supplementary to, rather than in replacement of, cotton acreage. Most of the added output was in the form of harvested nuts, but there was also some increase in peanut pasture hogged off. A sustained increase in peanut plantings of this sort was not a desirable long-range adjustment, as peanuts are a heavily soil-depleting crop, and intensified production could not be continued for long without unusual applications of nitrogenous fertilizer or rotation with other crops. Furthermore, harvesting was increasingly difficult during the latter years of the war as a consequence of the scarcity and relative expensiveness of harvesting equipment and the fact that the peanut harvest competed with cotton for labor. Total peanut acreage planted in the United States (in which Georgia was the leading state, followed by Alabama and Texas) rose from about three million acres in 1939 to about five million acres in 1943, after which it declined to an annual planting of slightly over four million acres for the remainder of the decade.⁸ Other supplementary crops in the hill areas were sweet potatoes and Irish potatoes, the acreage of which reached a peak in 1943, but thereafter fell to prewar levels or below.

In the Black Belt of Alabama and Mississippi, which is unusually adaptable to good stands of grassland, a major transition to livestock raising which had been initiated at the time of the boll weevil infestation received a strong impetus during the war. This transition was impeded at first by the necessity to find off-the-farm employment for

8. *Agricultural Statistics, 1950*, 142.



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FIGURE 5

considerable numbers of people before a more extensive type of farming could be undertaken. In addition, troublesome shortages of small grain equipment and of storage space occurred. These problems were largely overcome as the war went on, and the shift from intertilled cropping to a grazing economy began to take on features of stability as herds were built up, investment in equipment was effectuated, and permanent pastures were seeded in. A similar development occurred in scattered other parts of the South where conditions were suitable, as in the Mississippi Brown Loam and Texas Blackland areas, which had suffered severe soil depletion from years of row cropping. As a result an appreciable increase in cattle numbers within the southern region followed each year's decline in cotton acreage.

In the Mississippi-Yazoo Delta concentration on cotton production, for which the rich alluvial lands of this area are especially suited, continued throughout the war. The labor problem was met by some increased mechanization and the use of more nonresident workers. The principal crop substitutions were in supplementary enterprises; the traditional corn and hay crops gave way to soybeans and oats. Oat production remained high throughout the war because of the unusual demand for feedstuffs, but soybean acreage, which saw a phenomenal expansion until 1943, was cut back to prewar levels when farmers discovered that the new crop was highly vulnerable to damage from weather and insects.

In the Longleaf Pine Cut-over area of Mississippi and Louisiana the supplemental enterprises which developed in response to increased local demand were principally dairying and truck farming. The rapid enlargement of military and civilian population in nearby centers created a strong market for fluid milk which could not be fully met until the bottlenecks of inadequate dairy herds and milk processing plants had been overcome. The ending of the war severely reduced the milk market once more, but a residue of industrial population remained in many localities and allowed well established dairy enterprises to continue to operate, though on a reduced cost basis.

In the Southwest (Texas and Oklahoma), cotton production remained the most profitable enterprise on the better lands, but one or two bad planting seasons led farmers at the northern edge of the Cotton Belt to seed winter wheat as the best substitute crop. In other parts of this subregion there was a tremendous growth in acreage devoted to grain sorghum. Cotton-sorghum-livestock systems achieved consid-

erable efficiency because they reduced the need for seasonal hired labor and utilized family labor more continuously during the year. This shift was facilitated by the improvement of combines and the development of sorghum varieties suitable for combining, as well as by the strong demand for almost all forms of livestock. At prices prevailing during the war it was generally more profitable to market feed through livestock than on the cash market, and this practice in effect added a source of labor income to the farm. There were also increases in corn and small grain production, as well as in some minor crops such as flax.

This review of some of the kinds of land-use adjustments which were made in response to the changed conditions of the war does not of course approach comprehensiveness, but it should serve to illustrate some of the potentialities and some of the limitations in the transformation of southern agriculture into a more efficient collection of enterprises. Some of the shifts from cotton production, as we have seen, simply resulted in the abandonment of land which might later come back into production as population returned. In other cases the principal shift was to a crop (peanuts) as unsuited to good soil husbandry as cotton unless combined under a careful system of rotation with a soil-conserving legume such as blue lupine. Even where it appeared that a desirable long-term shift had been successfully made, the boom in the cotton market during the inflationary period shortly following the war made it doubtful that these transitions could be maintained. When cotton prices received by farmers increased 45 per cent in one year, 1946, agricultural economists in the Southeast began to fear that many farmers would plow up their barely established permanent pastures and plant cotton, if only in order not to forego the record of a continuous historical base for acreage allotments which they felt they might want in the future. For this reason these economists advised a change in the method of assigning cotton allotments which would not discourage the continuation of ventures into new farm enterprises.

Thus it appears that while the war stimulated innovations in farm operations, the period was not long enough to overcome traditional attitudes and to establish new customary patterns of agriculture, except in rather limited areas. Whether the changes which were made during the war were to survive depended a great deal on the perpetuation of some of the more important features of the new environment, such as the relative scarcity of farm labor and the development of new market

outlets for diversified crops, as well as on the extent to which farmers had committed themselves by purchases of machinery and other major investments to new farming systems.

THE POSTWAR OUTLOOK FOR COTTON

The course of events since World War II, including a number of strong influences acting from outside the cotton economy, has led to wide swings of opinion within relatively short intervals with respect to the outlook for cotton production as a profitable undertaking. These extremes of pessimism and optimism, and the factors responsible for them, illustrate the difficulty experienced by cotton producers in assessing the long range prospects for their enterprise.

At the close of the war the prevailing outlook was one of almost unrelieved pessimism. As early as December, 1944, a Special Subcommittee on Cotton of the House Committee on Agriculture, headed by Congressman Stephen Pace of Georgia, had held extensive hearings on the problems which cotton farmers would face after the conclusion of hostilities. As a result of these and additional hearings held in May of the following year the Subcommittee, assisted by no less than forty-one public and private agencies engaged in research related to cotton, decided to sponsor a comprehensive program of investigation into the difficulties facing the cotton enterprise and the policies which might be pursued to overcome or mitigate them. One outcome of this concern was the passage of the Research and Marketing Act of 1946, which provided (in a broadened form to include all of American agriculture) for the expansion and coordination of federal, state, and private research to find new and wider uses for farm products—especially those likely to be in surplus.

This was regarded as essentially a long range program. In addition, the Subcommittee sponsored a short-term, fact-finding program to assemble in a comprehensive way the information related to the cotton problem which was already available. The product of this investigation was a valuable group of reports published in 1947 as the *Study of Agricultural and Economic Problems of the Cotton Belt*.⁹ The nine

9. U.S. House Committee on Agriculture, *Study of Agricultural and Economic Problems of the Cotton Belt*, Hearings before the Special Subcommittee on Cotton of the Committee on Agriculture, House of Representatives, 80th Congress, 1st Session, Part 1, July 7 and 8, 1947; Part 2, October 10, 1947 (Washington: Government Printing Office, 1947).

initial projects contained in this study included reports on needed adjustments to secure efficiency in southern agriculture, marketing problems faced by cotton, anticipated competition from substitute products, and an analysis of foreign market outlets.

The restrained outlook of the committee of highly informed agricultural economists who prepared the report on needed adjustments is significantly revealed in the price and demand expectations which they used as working assumptions in making their recommendations. They assumed that under competitive conditions, with no production restrictions or price supports, average demand for American cotton for eight or ten years into the future could be expected to reach about thirteen million bales a year, but at an average farm price of only fourteen cents a pound. If, on the other hand, parity prices were to be maintained at an estimated level of twenty cents a pound, a system of drastic production controls would have to be applied, since the annual demand could not be expected to exceed an average of six million bales.

By an irony of coincidence, the crop season following the issuance of this study, begun two years before, was one of the best ever enjoyed by cotton farmers. In 1947 a twelve-million-bale crop was sold for an average price of 31.9 cents per pound. Fortuitous events, including the fact that the short crops of the two preceding seasons were two of the three smallest in fifty years, undoubtedly contributed to this circumstance, but the fact remains that in no succeeding year has the average price received by farmers fallen below 28.5 cents a pound, nor has the annual disappearance of American grown cotton been below twelve million bales. Even if allowance is made for general inflation and its effects on farmers' costs, the committee's anticipations, widely shared as they were at the time, have so far proved unduly pessimistic.¹⁰

10. These comments are not intended to discredit the analysis contained in the report, which was of a high order, nor to imply that the assumptions made were unwarranted on the basis of the evidence available at the time. They are merely meant to illustrate the opinion prevailing at the war's end and to emphasize the difficulty of predicting the future of an enterprise so beset with uncertainty and so heavily affected by extraneous events. Cf. *Report of the Secretary of Agriculture, 1945* (Washington: Government Printing Office, 1945), 24-32; and Agricultural Department of the Chamber of Commerce of the United States, *The Cotton Problem in 1946* (Washington: Chamber of Commerce of the United States, 1946).

Reasons for Postwar Pessimism

What were the grounds for such pessimism at the end of the war? They consisted of the following:

On the supply side, despite the demands of the war, enormous stocks of cotton remained on hand at its close, both in the United States and in other cotton-producing countries. The world carry-over in 1945 of nearly twenty-seven million bales was, as we have noted, the largest in history. And it was expected that some cotton-producing countries, whose normal food imports had been cut off during the war, would return their diverted acreages to the growth of cotton.

Plantings in the United States were also expected to go up with the return to the farms of demobilized veterans and unemployed war workers. A resumption of the prewar population pressure on the land was considered almost inevitable.

On the demand side, several factors contributed to the gloomy outlook. The general expectation, based on events following World War I, was that there would be a brief postwar business boom in the United States, succeeded by a recession which would severely affect the domestic cotton market.¹¹

Even if this recession turned out to be milder than was feared, it was recognized that a fundamental change had taken place in the competitive position of rayon and other substitutes versus cotton. As has been described earlier, a continuous technological advance in the rayon industry had not only greatly improved the quality and versatility of the product, but had lowered the price of rayon relative to that of cotton until, by 1944, rayon was actually cheaper. Both fibers rose in price during the postwar period, but since cotton rose more rapidly, the advantage continued to lie with rayon. Moreover, domestic production of rayon had mounted steadily during the war, so that by 1945 it was twice what it had been in 1939, and was then approaching the equivalent of two million bales of cotton.¹²

Even though population, and hence the total potential demand for textile fibers, was increasing throughout this period, rayon consump-

11. For a discussion of the problem, see, for example, *What Peace Can Mean to American Farmers: Post-War Agriculture and Employment* (Washington: U.S.D.A., Miscellaneous Publication 562, May, 1945), and succeeding reports in this series.

12. U.S. Bureau of Agricultural Economics, *Statistics on Cotton and Related Data* (Washington: U.S.D.A. Statistical Bulletin 99, June, 1951), 387.

tion was increasing at a greater rate than that of cotton. In 1937 the per capita consumption of rayon in the United States was 2.4 pounds, or 8 per cent of the per capita consumption of cotton. By 1950 rayon consumption had increased to 8.9 pounds per capita, or 29 per cent of that of cotton.¹³

The most serious effect on the market for cotton was its declining importance in the manufacture of automobile tires, which had formed the largest single end-use product for cotton prior to the war. In 1939 about 610,000 bales of cotton went into tire cord and fabric alone. Although the absolute quantity of cotton used for this purpose increased steadily from 1942 to 1947 because of the increased output of the tire industry, cotton was rapidly being overtaken by rayon in the proportion of each fiber being used. After 1947 cotton experienced a sharp absolute decline in this end use.¹⁴ In the last year of the war about 682,000 bales of cotton were used for tire cord, as compared with rayon fiber equivalent to 441,000 bales. By 1949 rayon had captured nearly two-thirds of the market, or an equivalent of 661,000 bales, as compared with cotton's 384,000 bales.

It is worth noting that although it was the quality advantage of synthetic fiber in heavy-duty tires which first stimulated interest in its use for tire manufacture, the principal factor in the large-scale substitution of rayon for cotton in passenger-car tires since the war has not been the intrinsic superiority of rayon for this purpose, but its price advantage. By the end of the decade the only thing preventing rayon from taking over the entire market was the limited plant capacity for the production of high-tenacity filament yarn. Thus as long as the price of cotton remained relatively high the only prospect appeared to be a declining residual market in this end use.

Competition from rayon was of course not confined to the tire cord market. Along with other synthetics such as nylon and, more recently, Orlon and Dacron, rayon continued to make inroads upon other established uses for cotton, especially in the women's apparel field. A more

13. Frank Lowenstein, "Factors Affecting the Domestic Mill Consumption of Cotton," *Agricultural Economics Research*, IV, No. 2 (April, 1952), 48.

14. M. K. Horne, Jr., Frank A. McCord and others, *Cotton Counts Its Customers*, Supplement No. 3 and succeeding issues for 1947, and 1948-1949 (Memphis: National Cotton Council of America, May, 1948, 5; December, 1949, 13; and October, 1950, 14); *Statistics on Cotton and Related Data*, 385, 391. Cf. statement by M. K. Horne, Jr., in U.S. House Committee on Agriculture, *Study of Agricultural and Economic Problems of the Cotton Belt*, 255-61.

important development, in terms of the volume of cotton displaced, was the increasing competition from paper in the bag industry. The manufacture of bags from cotton had long been its second most important utilization, but because of the acute demand for bagging and the shortage of burlap during the war, this use ranked first with a record consumption of 820,000 bales of cotton in 1943.¹⁵ Thereafter, however, and despite an increased total market for bags, the use of cotton declined. At the same time the output of paper for shipping sacks increased from 195,000 tons in 1940 to 667,000 tons in 1948. Again it was cotton's price disadvantage which seemed to be responsible for the increasing substitution.

Another major reason for pessimism about the cotton prospect at the end of World War II was the foreign market situation. It was believed that the defeat of Germany and Japan had virtually destroyed two of the largest prewar customers for cotton exports.¹⁶ Other important buyers, such as the United Kingdom and France, had not only suffered physical impairment of their mill capacity, but were unable to find the means of payment in American dollars for necessary imports. Under UNRRA and other emergency relief programs then in effect only moderate amounts of cotton could be financed and shipped. Moreover, it was anticipated that in seeking to achieve recovery, western European nations would have to employ measures for economic self-sufficiency designed to conserve their depleted foreign credits. This was interpreted to mean a continuation of the trend toward the manufacture of textiles from domestically produced synthetic fibers rather than the resumption of cotton manufacture requiring imports.

To be sure, the United States had at hand, under the terms of the Surplus Property Disposal Act of 1944, a potent means of moving cotton into foreign markets at competitive prices by the use of an export subsidy which was set at four cents a pound. However, the government was reluctant to use this instrument vigorously since it

15. Robert B. Evans, "The Utilization of American Cotton," *Crops in Peace and War, The Yearbook of Agriculture, 1950-51* (Washington: Government Printing Office, 1951), 385.

16. At the end of the war it was estimated that about 70 to 80 per cent of the 12.3 million textile spindles that Japan had had in 1939 had been destroyed. This left her with only about one-fifth of her cotton textile manufacturing capacity and one-third of her rayon production capacity. Glenn L. Johnson, "Cotton Farmers Hold Acreage Down," *Agricultural Situation*, 30, No. 8 (August, 1946), 11-12.

clearly conflicted with an announced policy to promote cooperation and avoid discrimination in foreign trade in the postwar period.¹⁷

The Inflationary Boom and Producers' Reactions

A number of factors, some of which have already been mentioned, combined to change the outlook completely within two years after the end of the war. Partly because farmers considered the prospects for cotton, relative to other crops, to be unfavorable, and partly because of bad weather and severe infestations of the boll weevil, plantings were greatly reduced in 1945 and 1946, yields were somewhat lower than usual, and the resulting crops were extremely small. At the same time demand reached unexpected heights. In consequence, the domestic disappearance (consumption and exports) greatly exceeded production during these two years, the annual carry-over was reduced to insignificance, and the amount of cotton on which farmers asked the Commodity Credit Corporation to make price-support loans was negligible. The farm price of cotton, which was no doubt also influenced by the general rise in prices following the relaxation of wartime controls, rose sharply from an average of 22.5 cents in 1945 to 32.6 cents in 1946.

By 1947 there was serious concern about the possibility of a cotton shortage, and this enabled farmers to sell a much larger crop at prices averaging nearly as high as those prevailing in 1946. Thus was ushered in a period of several years of extraordinarily high returns to cotton farmers. In his report for 1947 Secretary of Agriculture Clinton P. Anderson estimated that cotton producers would receive that year from an acreage one-fourth less than the 1935-39 average a gross income more than two and one-half times as great as the average income in the 1935-39 period. Furthermore, after allowing for increases in prices paid by farmers plus interest and taxes, the gross returns were expected to represent two and one-third times the purchasing power obtained from the crop in the 1935-39 period.¹⁸ The farm value of the lint and cottonseed crop in 1947 reached \$2,295,000, and in every succeeding year it has exceeded that figure.

17. *Report of the Secretary of Agriculture, 1945* (Washington: Government Printing Office, 1945), 26-29. The rate was reduced to two cents a pound after February 13, 1947, and later in the year it was cut to one-half cent a pound. (*New York Times*, February 14, 1947, 35; *ibid.*, May 9, 1947, 35.)

18. *Report of the Secretary of Agriculture, 1947* (Washington: Government Printing Office, 1947), 30.

There were several reasons for the unexpectedly large demand for cotton in the postwar years. In the first place, the widely anticipated postwar recession in the United States did not materialize until late 1948, and even then was both comparatively mild and soon superseded by the inflationary upsurge following the outbreak of hostilities in Korea in mid-1950. Consumer incomes were maintained at high levels during these years. The resulting sustained expenditure on items using large quantities of cotton, such as men's clothing, bedsheets, and drapery and upholstery materials, was large enough to offset declines in other types of cotton consumption. Altogether the consumption of cotton by American mills during the five immediate postwar years was well above the average for the prewar period, although it remained below the wartime rate of consumption until 1950.

Secondly, the foreign demand also showed unanticipated strength as a result of a series of measures which the American government took to relieve the dollar shortage and promote recovery in western Europe and in the Far East. In July, 1946, the United Kingdom received a loan of three and three-fourths billion dollars, part of which was spent on the purchase of American cotton. France, Belgium, and the Netherlands received similar rehabilitation loans in smaller amounts, and the Export-Import Bank made special cotton loans to China, Italy, Czechoslovakia, Hungary, and Finland. In addition, an emergency assistance program for the textile industries of occupied Germany and Japan was established under which the last stocks of cotton held by the Commodity Credit Corporation—slightly more than one million bales—were cleaned out. The raw cotton was provided to these countries in exchange for three-fifths of the textiles which could be produced from it. This cloth was then disposed of in countries still suffering from the effects of the war. The two-fifths which remained in the former enemy countries was regarded as a means of providing employment and reducing the direct occupation costs. In the aggregate it is estimated that two-thirds of the American cotton exported during the year ending July 31, 1947, moved out under government credits of various kinds, including the processing agreements for Japan and Germany.¹⁹

Since most of these were temporary measures, exports of cotton fell off considerably during the following year. After April, 1948, however, when the European Recovery Program went into effect, cotton

19. *Ibid.*, 31.

began to share importantly in the government-financed assistance going to western European and other Marshall Plan countries. During the 1948-49 season about 60 per cent of the cotton exports from this country were financed by Economic Cooperation Administration loans and grants, and another 15 to 20 per cent were financed by additional credits, including a special revolving fund of \$150,000,000, made available by the American government.²⁰

Over the initial four-year period of operation from April 3, 1948, until March 31, 1952, the ECA and its successor, the Mutual Security Agency, provided funds for the export of \$1,488,000,000 worth of American cotton.²¹ This represented one-eighth of the total funds which had until then been authorized for expenditure under the entire program. Under the stimulus of this expenditure cotton exports in 1949 for the first time reached their prewar level with total shipments of about six million bales (see Figure 4).

Fortunately this rise in exports tended to coincide with the decline in domestic consumption which took place during the 1948-49 recession, and thus helped to maintain a relatively high level of total demand for American cotton. Nevertheless, by 1948 producers had responded so enthusiastically to the postwar price incentive that they produced nearly fifteen million bales of cotton, as compared with an average of less than ten million bales for the three previous years. They followed this in 1949 with a crop of sixteen million bales, the fourth largest on record. The domestic carry-over, which had reached its lowest point at the beginning of the 1948 season, once more began to mount, and prices showed signs of breaking. In September, 1948, the Department of Agriculture announced that the price of cotton had fallen below parity for the first time in three years.²² One-third of the 1948 crop, the largest volume since 1937, and one-fifth of the large 1949 crop entered the government price-support loan.²³

Agricultural officials became alarmed at the volatility of farmers' readiness to increase the supply of cotton in response to demand factors which they could only consider as temporary. The ECA program

20. *Report of the Secretary of Agriculture, 1949* (Washington: Government Printing Office, 1949), 39.

21. U.S. Mutual Security Agency, *Monthly Report of the Mutual Security Agency to the Public Advisory Board* (Washington: Mutual Security Agency, June 6, 1952), 37.

22. *New York Times*, September 9, 1948, 45.

23. U.S. Bureau of Agricultural Economics, *Statistics on Cotton and Related Data*, 239.

was scheduled to end in 1952, consumers' deferred demands resulting from the war appeared to be largely satisfied, and competition was increasing at home and abroad from rayon and foreign-grown cotton.

Indeed, by the beginning of the 1950 crop season the surplus had reached such a magnitude that existing legislation made it mandatory for the Secretary of Agriculture, for the first time in the postwar era, to announce that marketing quotas would be applied to the forthcoming crop. In order to bring the supply more nearly into adjustment with anticipated requirements, a drastic curtailment in planted acreage was ordered. Accordingly, acreage allotments were assigned which were intended to reduce plantings from over 27,700,000 acres in 1949 to 21,700,000 acres in 1950. It was expected that this would result in a crop of from twelve to twelve and a half million bales. However, because of unfavorable weather in portions of the Cotton Belt, and because of the method by which minimum acreages were reserved to each county, only a little over nineteen million acres of cotton were actually planted. This was one of the smallest plantings in sixty-five years. In light of the developments which followed there was a good deal of complaint from producers in the newer cotton areas, who had an insufficient historical base to qualify for larger acreages, that the formula which was applied discriminated against them in favor of farmers in the older areas who had by this time largely turned away from cotton production. In any event, the production for the year reached only slightly over ten million bales, a drop of 37 per cent below the previous season's output.

THE EFFECT OF THE KOREAN OUTBREAK

The sudden reversal of economic conditions which occurred with the outbreak of hostilities in Korea thus found cotton growers by unwitting circumstances unable to take productive advantage of the resumption of strong demand. Caught in mid-season with an uncommonly small planting of cotton, they could only hope that market prices would compensate for an unavoidably reduced output. There ensued a series of events unique in the history of modern farm policy.

The first of these was the imposition by Secretary of Agriculture Charles F. Brannan in October, 1950, of export quotas on cotton shipments to all foreign countries with the exception of Canada. While the primary purpose of imposing these limitations on exports was to insure

that adequate supplies would be available to domestic mills, Secretary Brannan stated that they were for the further purpose of preventing runaway prices, which could "well set off demand for controls across the board for many other items."²⁴ In the long struggle to preserve foreign markets, no one had contemplated that export quotas for cotton would ever be necessary. Strong protests were made by various cotton interests, and the original stringent quotas were shortly increased by 62 per cent to a total of 3,496,000 bales for the eight months ending March 31, 1951.

A second novel outcome was the imposition of ceiling prices on raw cotton by Michael V. DiSalle, Director of Price Stabilization, on March 3, 1951. This politically unpopular action had never been achieved, although often advocated, by officials of the Office of Price Administration during World War II. The ceilings were set at an average price of 45.76 cents per pound, which represented 125 per cent of parity at the time. The action resulted from the fact that the average farm price of cotton had risen by almost 40 per cent from the start of the Korean war in June, 1950, when it was 29.9 cents, until January, 1951, when it reached 41.3 cents. It was felt that a further rise was virtually certain, unless legally forestalled, and that this would press irresistibly upon the price of finished cloth.

For the season's crop as a whole, most of which had been sold before the imposition of ceilings, farmers received an average of forty cents a pound, which in money terms was higher than at any time since the Civil War. Even at the reduced level of output the farm value of the staple and seed reached \$2,356,000,000.

Another unusual development at this time was that, as a result of the imposition of export quotas and ceiling prices on American cotton, the world price of cotton actually exceeded that of cotton in the domestic market—a relationship which had rarely occurred in recent times. Most cotton exporting countries, since their domestic requirements were relatively unimportant, had not placed quantitative restrictions on exports, but had levied an export duty which they raised sharply as soon as the world cotton shortage became apparent. Furthermore, many of these countries had the trading advantage with European buyers of being on a "soft currency" basis. Consequently comparable grades of foreign growths for a time sold at prices as much as thirty

24. *New York Times*, October 11, 1950, 49.

cents above the ceiling price of approximately forty-six cents for American cotton.²⁵

While this relationship tended to fluctuate during the succeeding season, the fact that it occurred at all emphasizes the degree of segregation which has taken place since the 1930's between the foreign and domestic cotton markets, as well as the difference in policy considerations which govern the respective market situations. Thus it appears that even if American cotton can compete pricewise with foreign growths in the future, the persistence of the dollar shortage may nevertheless at times compel foreign buyers to pay a premium in more readily obtainable currencies in order to meet their balance of payments difficulties. It should be clear from the preceding review that the recovery of the American export market for cotton since the end of the war has been so heavily dependent upon the liberal extension of foreign credits by the United States government that the future of the cotton enterprise at recent levels of production hangs to a considerable degree upon finding a longer term solution to the international balance of payments problem.

THE SIGNIFICANCE OF MECHANIZATION FOR THE COMPETITIVE POSITION OF COTTON

If the above discussion has been burdened with tedious detail concerning the season-to-season changes in the cotton outlook, it should nevertheless have exhibited two critical aspects of the factors affecting the future of cotton growing as a profitable enterprise: (1) the abrupt and, to some degree, unregulated shifts in the total level of output to which cotton production in this country is still subject from year to year; (2) the highly unpredictable course of short-term fluctuations in demand so long as the world remains in its present disturbed economic and political situation. These two aspects of instability have been present throughout the postwar period, and although this has, in general, been an exceptionally prosperous period for cotton producers, exogenous events have so manifestly played a large role in this prosperity that it would be foolhardy to say that cotton has reached a condition of postwar adjustment. In fact, close attention to recent experience raises some very serious questions as to the basis on

25. *New York Times*, August 12, 1951, Part III, 1.

which it would be feasible to rationalize cotton production as an industry.

Notwithstanding the peculiar problems of the export market which have been alluded to above, a good many students of the cotton enterprise, including some leading producers and some members of Congress from cotton states, have concluded that the long-run solution for the problems of cotton producers is not to be found in a continuous upward movement of cotton prices, but, on the contrary, in the reduction of farming costs so that cotton can be sold at prices competitive with those of its numerous substitutes.²⁶ While they regard the parity price program as a necessary interim device to maintain farm incomes, they attach great significance to the process of mechanization of production as a means to reduce cotton prices sufficiently to recapture markets which in recent years have tended to go to rayon, paper, and other substitutes. Some of the implications of this solution and the prospects of its accomplishment will be examined in the concluding chapter.

26. See statements by various authorities in the *New York Times*, September 22, 1948, 62; July 28, 1949, 37; and January 3, 1950, 78; and article by Robert B. Evans, executive secretary of the International Cotton Advisory Committee, on "The Utilization of American Cotton," *Crops in Peace and War, The Yearbook of Agriculture*, 1950-51, 377-86.

PART 2

HOW MECHANIZATION TOOK HOLD

CHAPTER 5

The Nature of the Problem

IN PART I we have examined the long-term development of basic institutions in the cotton economy and considered the unstabilizing impact of outside events on the enterprise. Part 2 will describe the process of technological development in cotton growing, already well advanced in some areas but hardly begun in others. This process is of course intimately bound up with the slow change in institutions and has been influenced by the same set of outside events that has affected the cotton economy generally, so that it has been necessary to allude to mechanization from time to time in the foregoing discussion. However, as in other cases of the invention, development, and application of important new techniques, the introduction of innovations in cotton farming has an evolutionary history of its own and a particularly fascinating one in view of the formidable technical, economic, and social problems which had to be overcome in order to establish the possibility of mechanized agriculture in the South.

It should be remarked that the term "mechanization" as used in the following discussion is intended to refer to the entire complex of mechanical devices, biological and chemical techniques, and improved cultural practices which together form the current revolution in methods of cotton production. The discussion will include innovations not only in methods of growing and harvesting the crop, but in its preparation for market. This is because the ginning and baling process

importantly affects the quality characteristics of the lint fiber, and because the producer ordinarily retains title to his crop until it has been partially processed through the ginning stage.

THE DELAY IN FINDING MECHANICAL SOLUTIONS

Attempts to relieve the labor problem in cotton production have not lacked variety. As early as 1820 an imaginative Louisiana planter, confronted with a scarcity of labor to harvest his crop, imported a cargo of Brazilian monkeys with the hope of training them to pick cotton.¹ It is interesting to speculate what the results of this experiment, coming so early in the development of the enterprise, might have been had it proved successful. It is conceivable that monkeys would have replaced slaves to an important degree, and that the racial composition of the South would today be markedly different from its present make-up. Apparently, however, monkeys could not be satisfactorily trained to perform the most laborious part of the production process, not to overlook the other necessary tasks involved in raising cotton.

Nevertheless, since cotton production has always involved a great deal of monotonous, fatiguing labor, requiring the hand picker to stoop or crawl on his knees all day dragging a heavy cotton sack behind him, it must have occurred many times to those familiar with the crop that a labor-saving solution would be greatly welcomed. Surprisingly long periods elapsed between successive stages in the development and adoption of such solutions.

The first recorded invention of a machine to harvest cotton was a mule-drawn picker patented by Samuel S. Rembert and Jedediah Prescott, of Memphis, in 1850.² This machine embraced both picking cylinders and picking disks, and represented a simple prototype of the modern spindle picker. Although it offered a challenge to improvement by other inventors, very little progress was made on this type of machine for forty years, at the end of which time Angus Campbell began to work out the mechanical principles for the rotating spindle.

1. Arthur W. Page, "A Cotton Harvester at Last," *World's Work*, XXI (December, 1910), 13,750.

2. U. S. Commissioner of Patents, *Report, 1850. Part I, Arts and Manufactures* (Washington: Government Printing Office, 1850), 233-34. Cited by Gilbert C. Fite in his excellent brief account, "Recent Progress in the Mechanization of Cotton Production in the United States," *Agricultural History*, 24, No. 1 (January, 1950), 23.

It took almost as long again before John Rust in 1927 discovered the principle of the moistened spindle which has helped to make the picker a success. And it was not until 1948—nearly a century after the patenting of Rembert and Prescott's machine—that a practical spindle picker, developed after long years of research by engineers of the International Harvester Company, was put into quantity production for commercial sale.

In the meantime almost every other conceivable method of extracting cotton from the plant had been tried. Few inventors had the persistence or the financial support to achieve a successful solution to the problem. The mechanical stripper, which has had an important though geographically limited role in the mechanization of cotton production, was invented in principle as early as 1871. Yet stripping by machine did not actually receive an extensive trial until 1926, when a variety of homemade models were put into use in the Texas Panhandle. Improved, factory-manufactured strippers were not widely adopted in the High Plains until the latter years of World War II, some twenty years later.

CONTRASTING EXPERIENCE IN THE MECHANIZATION OF OTHER CROPS

While the development and introduction of successful harvesting equipment, as well as improved machines for the cultivation of the crop, were thus long delayed in cotton, the mechanization problems in other important crops had largely been solved. At the cost of interrupting the story at this point, it seems useful to review briefly the course of mechanization in other crops as an aid to understanding the slowness of the process in cotton.

It may be observed that in most other crops the technical requirements for mechanical alternatives to hand methods have been relatively simple, at least in their early stages. Moreover, in these crops by the time the tractor became available there had already occurred a fairly extensive stream of inventions and improvements which could be adapted and harnessed to the new source of motive power. The variety of inventions already on hand made possible a degree of technological borrowing from which cotton was unable to benefit.

Another factor that should not be overlooked, although its importance is difficult to estimate, is the circumstance that farming in the frontier areas that lay outside the South was organized under the home-

stead system. Farmers operating their own homesteads presumably had a direct interest in the introduction of labor-saving devices. Even though machines did not reduce, and indeed sometimes raised, out-of-pocket costs, the saving in labor which they made possible, especially at peak seasons, could be expected to appeal to the yeoman farmer who did all, or nearly all, of his own work. This factor, which has been noted by Horine and others, need not be overemphasized, since a similar condition existed in parts of the South and Southwest without in itself bringing forward significant labor-saving inventions.

Pioneer Inventions in Small Grains

The first advance in harvesting methods—nearly always the chief bottleneck in agricultural operations—came in small grains. Cyrus H. McCormick invented his grain reaper in 1831 and put it into commercial production by 1847.³ His basic invention was subsequently enlarged in significance by a stream of improvements and complementary inventions, including the harvester, the twine binder, the header, and the stationary thresher. By the end of the century these machines came to dominate the wheat fields of the Great Plains. The extensive introduction of the combined harvester-thresher was delayed until World War I, when this type of machine was re-introduced into the plains states via the West Coast.

A workable combine, which cut a fifteen-foot swath, threshed and winnowed the grain, and delivered it to a bag, had been constructed in Michigan as early as 1836, only five years after the invention of McCormick's reaper. Although this machine was improved until by 1843 it would cut and thresh twenty-five acres a day, it was reluctantly abandoned ten years later because no way had been found to eliminate the problem of spoilage resulting from excessive moisture in the threshed grain. Thereupon the combine was shipped around Cape Horn to California, where in a more favorable climate it was successfully adopted and enlarged. In 1880 it entered commercial production

3. The ensuing summary of major achievements in the mechanization of crops other than cotton has drawn heavily on the valuable illustrated chronicle by Bert S. Gittins, *Land of Plenty* (Chicago: Farm Equipment Institute, 1950), which includes a list of dates of significant innovations in farm technology. A standard source for information on early American farm mechanization is R. L. Ardrey, *American Agricultural Implements* (Chicago: the author, c. 1894). See also M. C. Horine, "Farming by Machinery," *A Popular History of American Invention*, ed. Waldemar Kaempffert (New York: Charles S. Scribner's Sons, 1924), II, 246-309.

in the Far West. In some of its versions the combine became a ponderous Juggernaut weighing over fifteen tons, cutting a thirty-five foot swath, and requiring forty horses to drag through the fields. It was clear that a source of increased power was needed. A steam engine for auxiliary power was mounted on a combine as early as 1871, and about 1886 there appeared a creation described as follows: "First steam-powered, self-propelled, straw-burning combine; also first steam traction engine to operate both backward and forward in its work of pushing the combine and pulling plows." ⁴ Thus was heralded an early version of the steam tractor, the forerunner of the modern internal-combustion tractor.

The gasoline tractor has become the symbol of farm mechanization in all its forms because of the increased power which it has made available on the farm and because of its versatility both as a stationary and as a mobile engine. While not confined to grain farming, of course, the gasoline tractor was first put to extensive use in the small grain areas during and following World War I. Experimental models of self-propelled gasoline traction engines had appeared as early as 1892, and limited factory production began in 1903. It was in 1918, however, in response to the wartime demand that mass-production techniques were first applied to tractor output.

A series of improvements in basic design ensued, the most notable of which were the development of the all-purpose, three-wheeled tractor in 1924, and the equipment of tractors with pneumatic rubber tires in 1932. In comparison with earlier models the all-purpose tractor was a considerably lighter, yet relatively powerful, machine whose tricycle mounting for the first time combined plow-pulling efficiency with general usefulness for row crop work. Previous to the advent of this type of machine, the tractor was largely confined to the heavy work of plowing and disking, and to the belt operation of stationary machines. Farmers had to continue to rely on horses and mules for the lighter field work. This represented an expensive duplication of power which, as the tractor became more versatile, could be eliminated. As a result, the number of horses and mules on American farms, which had reached a peak of nearly twenty-seven million in 1918, began rapidly to decline after 1924 from about twenty-three million in that year to seven and a half million in 1950.⁵ This released for other uses vast

4. Gittins, *Land of Plenty*, 27.

5. U.S. Department of Agriculture, *Agricultural Statistics*, 1942, 450; *ibid.*, 1951, 382.

acres which would otherwise have had to be devoted to producing feed for work animals.

The replacement of steel wheels with low-pressure rubber tires had two important cost-saving effects. Rubber tires greatly increased the speed and flexibility of farm operations. In addition, by reducing ground friction they increased the effective drawbar power of the tractor and brought about fuel savings of as much as 25 per cent on some models.

Improvements in the gasoline tractor in turn made possible the redesign of the grain combine into a smaller machine suited to the harvesting of a wide variety of crops—grass and legume seeds, beans and grain sorghums, as well as small grains. It was a revolutionary occurrence when the one-man combine powered by a small two-plow tractor made its appearance in 1935, because relatively small farmers in all regions could now use a combine on small grains, whereas before the method had been principally confined to the large farms of the commercial wheat region. By 1946 it was estimated that about 90 per cent of the acreage of small grains in the United States was harvested by tractor-drawn machines, and that about two-thirds of the crop was harvested with combines.⁶ In the southeastern and Appalachian states one-third or more of the acreage continued to be harvested with animal-drawn machines, and a small amount of grain was still cradled by hand.

The total mechanization of small grain production was facilitated by the development of a considerable variety of implements in addition to the harvest machinery. These have included an intermittent flow of improvements in the plow, the harrow, and the seed drill, all of which were rapidly adapted to the new forms of draft power as these became available.

Mechanizing Corn Production

In corn growing progress was somewhat slower than in small grains, but the technical problems standing in the way of complete mechanization nonetheless had been virtually overcome by 1928. The first important patent on a corn picker was granted in 1880, and

6. A. P. Brodell and J. A. Ewing, *Use of Tractor Power, Animal Power, and Hand Methods in Crop Production* (Washington: Bureau of Agricultural Economics, FM-69, mimeographed, July, 1948), 12.

commercial production of a horse-drawn machine was reported by 1909. The corn picker had to await the application of tractor power, however, before its usefulness was fully established. A two-row picker husker designed for power take-off operation was built in 1928. Within the same year a one-row tractor-mounted model was developed, followed the next year by a two-row mounted machine.

The introduction of high-yielding hybrid corn helped to encourage the general acceptance of mechanical picking, which spread gradually during the 1930's and caught on with particular rapidity during World War II. In 1938 about 12 per cent of the acreage of corn harvested for grain in the United States was machine-picked from the standing stalk.⁷ By 1943 this had increased to 27 per cent and by 1946 to 41 per cent. In the Corn Belt states of Iowa, Illinois, Minnesota, and the Dakotas, where the use of mechanical field pickers was most prevalent, more than 70 per cent of the acreage of corn for grain in 1946 was harvested with such machines.

Corn, being a row crop, posed special problems not encountered in growing small grains. It was necessary to secure a uniform, properly thinned stand, and to control weeds more effectively in the open rows. These were traditionally jobs for the man with the hoe. To a large degree these problems were solved mechanically well before the appearance of an acceptable picker. In 1860 a two-row corn planter was invented which was tripped by hand to space the seed for cross cultivation. In time this device was improved until it was fully automatic. During the 1890's it was combined with the single-kernel accumulative drop planter, which counted out any desired number of kernels to be planted in a hill and thus facilitated planting to a stand. Considerably later the rotary hoe came into use and made possible fast, early cultivation of row crops. With the advent of the tractor it was happily discovered that this attachment to break up the soil crust and kill young weeds worked most effectively at high speeds. Other tools for later cultivation, operated according to a cross-checking pattern wherever the terrain permits, as well as specialized harvesters such as the husker-shredder, husker-sheller, and self-propelled picker, have completed the requirements for the total mechanization of corn production.

7. Brodell and Ewing, *Use of Tractor Power*, 21-25.

Handling Hay and Forage Crops

Hay and forage crops have similarly gone through a process of extensive mechanization which not only greatly reduced the labor required to harvest and store feed for livestock, but significantly increased its nutritional value by improving its quality and by multiplying the forms in which it could be processed. By 1860 the two-wheeled, hinged-cutting-bar mowing machine had been developed to essentially its present form. It is reported that by 1865 nearly all hay in this country was cut mechanically except on the roughest ground. The horse-drawn spring-tooth sulky rake and the riding tedder for the handling and curing of hay on the ground were also developed during this period. They became very popular, although the remaining haying operations required the laborious use of the pitchfork for some time to come.

As the American cities grew, and with them their horse populations, they provided important markets for hay. The continuous baling press was invented in 1872, and after the railroads began to refuse to handle bulk hay during the 1890's, baling presses, operated by horse or steam power, came into extensive use. Other improvements in the handling of hay included the harpoon fork and overhead carrier for unloading at the barn, the side delivery and sweep or buck rakes, and the hay loader, all of which became much more serviceable with the application of tractor power. The windrow pickup hay baler was introduced in 1932 and has been rapidly adopted in recent years because of its convenience in saving at least two handlings of the crop. The increased speed with which hay is processed today directly affects its quality. Fast, careful raking of legumes, for example, saves the leaves, which contain two-thirds of the feeding value of the hay.

The ensilage method of preserving green feed for winter use that made such an enormous contribution to modern livestock feeding was introduced into this country from France during the 1870's. Farmers found that the fermentation process softened the tough corn stalks and made of them a succulent, digestible animal feed. One of the earliest American silos was built by Manly Miles of the University of Illinois in 1875, and his model was widely copied in the eastern states as well as throughout the Corn Belt. Trench silos, which have recently been reintroduced as an innovation in some parts of the South, were

actually among the first to be used, but were generally replaced by upright silos of square or circular design. Ensilage cutters appeared about the same time and silo-filling machines somewhat later. In 1936 a forage harvester was built which would pick up green hay from the windrow and chop it for grass silage, and eventually this machine was augmented so that it would cut and chop the green feed in a single operation. When this is blown into the silo the complete operation represents a substantial saving in time and effort over the old method of handling and re-handling the long, green hay with pitchforks.

Developments in Dairy Farming

For the farmer engaged in dairying, one of the most labor-consuming of farm enterprises, the above series of advances in field and barnyard practices marked the beginning of a revolution which has changed dairying from a subsidiary enterprise to a major farm specialty. Other important contributions to this process were the invention of the centrifugal cream separator in 1879, the Babcock cream tester in 1890, and the first vacuum milking machine with intermittent suction in 1895.⁸ The cream tester, in addition to providing the farmer with an accurate basis of payment for his product, enabled him to compare the value of the cows in his herd. This stimulated interest in selective breeding and in better feeding, and fostered the shift from beef and dual-purpose cattle to high-producing dairy stock.

The milking machine, unlike the cream separator, failed for a long time to be put to general use, even though power-operated models were available by the time of the first World War. The automatic milker came into its own, however, in response to the labor scarcity and acute demand for milk of World War II. There were 175,000 milking machines in use in the United States in 1940, and by 1945 despite restrictions on manufacture the number had increased to 379,000—a gain of 117 per cent within five years.⁹ By 1950 the number

8. A fully successful milking machine was not available in this country until 1905, when it was introduced from Scotland. Robert B. Elwood, Arthur A. Lewis, and Roland A. Struble, *Changes in Technology and Labor Requirements in Livestock Production: Dairying*. W.P.A. National Research Project Report No. A-14 (Washington: Bureau of Agricultural Economics, June, 1941), 47.

9. Sherman E. Johnson, *Changes in Farming* (Washington: Bureau of Agricultural Economics, FM-58 Revised, June, 1948), 16-17.

in use had reached 710,000, an increase of 306 per cent for the decade.¹⁰ Other important advances included the provision of automatic water bowls for cows, barn manure carriers, and electric milk coolers, as well as the application of findings in biological research to disease control and artificial insemination.

Because improvements in dairy practice tend to increase the amount of individual care—especially of a skilled sort—required by each cow, dairying will probably never become a fully mechanized enterprise. Nevertheless, the amount of manual labor required to feed and care for dairy stock in relation to output has been significantly lowered during the past forty years, and in commercial dairying the enterprise can now be said to be highly mechanized.

Cotton alone among the major American farm crops has tended to lag in advanced technological applications, and as late as the prewar decade the prevalent mode of production throughout large portions of the Cotton Belt was with one-row mule-drawn equipment, hand chopping and hoeing, and hand picking. Why has progress in the mechanization of cotton been so painfully slow?

As the preceding chapters have sought to show, until World War II institutional factors played an overwhelming part in discouraging sustained interest in devising and promoting the application of mechanical solutions to the production processes. But the technical problems have also been severe and peculiarly baffling. In order to appreciate them, the conditions of cotton production must be examined more closely.

THE NATURE OF THE TECHNICAL PROBLEM

Perhaps the chief factor complicating the problem of mechanizing cotton production has been the absence of standardization of the product and the conditions under which it is grown. To some extent this condition is due to unavoidable natural circumstances, but in other important respects it may be subject to control.

Diversity of Soil and Climatic Conditions

Cotton is grown under a tremendous diversity of soil and climatic conditions—from the worn-out sandhills and clay banks of the eastern

10. *Farm Implement News*, 72, No. 13 (July 10, 1951), 141.

uplands, where even intensive fertilization will frequently yield less than a third of a bale to the acre, to the fertile alluvial soils of the Delta, where yields of a bale to the acre are not uncommon, and the former desert land of central California, now irrigated, which sometimes yields two bales and regularly averages well over a bale of lint cotton to the acre. The region varies from the dry uplands of the High Plains, with 20 inches of rainfall and a 180-day growing season, to the humid subtropics of the Gulf Coast, with 60 inches of rain and a frost-free season of over 240 days. The resulting cotton plant varies greatly in its growth characteristics, for which the environment is at least partly responsible. It may be a scrubby bush, lower than a man's knee, in Georgia; a rank, wide-branching plant reaching over his head in the Delta; and a heavily fruited, almost leafless stalk in West Texas. To design a single machine to harvest all of these growths is a vastly different problem from that confronted by Cyrus McCormick and Obed Hussey in devising a mechanical method of reaping small grain.

Differences in Terrain

Among other important natural factors is the terrain, which in some areas consists of broad, flat plains adapted to mechanization, and in others of broken, sidehill patches of soil. This has helped to determine the typical size of farm in each type-of-farming region and has thus planted institutional as well as technological barriers in the way of mechanizing certain portions of the Cotton Belt. Soil types vary a great deal, and this factor has provided a considerable obstacle in areas which are otherwise well suited for the use of machines. The original International Harvester spindle-type cotton picker which underwent extensive testing in the Mississippi Delta weighed more than five tons when mounted onto an M tractor powerful enough to operate it effectively. In the heavy gumbo and buckshot soils of this area and the Texas Blacklands such a machine was likely to bog down and become unusable in a wet season.¹¹ This presented engineers with a special complication requiring extensive redesigning.

11. Charles R. Sayre, Jr., "The Economics of Mechanization in Cotton Production" (Ph.D. dissertation, Harvard University, November, 1948), 7.

Differences in Genetic Characteristics of the Plant

Diversities over which it is now believed there can be a significant measure of control are those related to the genetic characteristics of the plant itself. Cotton grown in the United States, although limited to one genus (*Gossypium*) of the mallow family (which includes such diverse members as okra, the common hollyhock, the ornamental rose of Sharon, and the wild mallows of the field), and largely confined to one type, American upland, nevertheless numbered more than five hundred varieties at the beginning of the century.¹² Some elimination of poor varieties and standardization through the establishment of one-variety communities has since taken place, but there are still a great many strains in cultivation with significantly distinctive characteristics. For example, the most popular varieties of cotton now grown in this country have a leaf whose under surface is very hairy and not well suited to clean picking by machine. The smooth-leaf strains produce a cleaner grade of cotton, but in breeding tests so far conducted have been characterized by poor yields. Countless breeding trials are necessary in order to develop strains suitable for mechanical picking and yet preserve other desirable properties, such as high yields, longer staple length, good spinning quality, and disease resistance. These trials have been going on for some time at governmental and commercial breeding and testing stations.

Differences in Cultural Practices

Cultural practices also importantly affect the diversities in plant characteristics. The same variety of cotton may be spaced in the row so that it produces a plant with three vegetative branches and five or six bolls, which will easily go through a machine stripper, or one with eight vegetative branches and three bolls, which will tend to clog it up. Farmers often have firm, though not necessarily verified, opinions regarding the proper spacing of plants for maximum yields, and prevailing cultural practices are therefore not readily changed. It was believed for a time that plants should be wide-spaced for boll weevil control, on the hypothesis that allowing more sunshine into the rows would kill the weevil grubs in the squares or bolls which had fallen off the plants. Later it was established that

12. U.S. Bureau of Plant Industry, Soils, and Agricultural Engineering, *Better Cottons* (Beltsville: U.S. Department of Agriculture, September, 1947), 897, 955.

close-spacing was preferable because it helped the plant to mature earlier, ahead of the time for weevil infestation, and yet did not adversely affect the yield. Such a finding usually requires a considerable time to be widely disseminated and accepted, and the tendency has therefore been for a wide variety of planting practices to persist among farmers.

In considering the effect of these diversities on the rate of mechanization in cotton harvesting it should be noted that the absence of standardized conditions of production throughout the Cotton Belt would not necessarily prevent the development of a satisfactory mechanical picker which could be used under limited conditions, but it would seriously affect the expectations of manufacturers concerning the prospect of a mass market for an expensive, complicated machine such as would be required for general adoption. Hence the application of mass production techniques to its manufacture could be expected to be delayed. This, as we shall see, is approximately what happened.

Fruiting Characteristics of Cotton

To complicate matters somewhat further for the would-be inventor of a satisfactory mechanical picker, the bolls on the plant do not ripen and burst to expose the fleecy lint at a uniform rate. For this reason it has been customary in hand picking to go over the crop two, three, or even four times, gathering the lint by stages as it becomes ready. To postpone picking until all the bolls are open would subject the already ripened cotton to damage from exposure to the weather. To be successful a mechanical picker must gather the early crop without injuring the green, unopened bolls which remain on the plant, so that their contents may ripen for subsequent picking. It must also mix as little green leaf trash as possible with the cotton, since the lint will otherwise become stained and lowered in grade. In addition, in some areas there are particularly pernicious infestations of trailing vines and tall grasses which tangle in the revolving parts of machines and which, when drawn into the harvested lint, are very difficult to remove.

THE CUMULATIVE CHARACTER OF
TECHNICAL PROGRESS

The progress of technological advance is a cumulative, proliferating one, in which new methods and devices are extended by multiple application and cross-fertilization. Nowhere is this more clearly illustrated than in the history of farming by machine. The phenomenal spread of mechanization through the small grain areas during the past century was greatly assisted by the possibility of adapting, recombining, and improving a few basic inventions—a possibility from which the Cotton Belt received little benefit because its problems were so different. It is said that one of the reasons for Cyrus McCormick's renowned commercial triumph over Obed Hussey, who had patented a successfully competitive reaper the year before McCormick, was that McCormick was willing to borrow and buy ideas from whatever source in order to keep his line of implements in a constant state of improvement. Hussey, on the other hand, persisted in depending on his own inventive resources, which in the long run proved too limited.¹³

Slight modifications in basic machines thus resulted over time in greatly improved efficiencies. The Marsh brothers' harvester of 1858 was essentially a reaper with a platform attached, on which two men could ride and tie the sheaves as they came from the reel. John F. Appleby's self-binder, ingenious and labor-saving as his twine knotter was, represented but another improvement on the reaper-harvester. The header was simply a harvester with the cutter bar set high. The best example of all in this technological stream is the multi-purpose combine which, as it emerged, incorporated elements of a great number of less complex machines.

Many additional illustrations could be cited to show the importance of borrowing, combining, and adapting in extending a process of mechanization, once it is begun. With the outstanding exception of the internal combustion tractor, which now furnishes a common source of power to all types of field machines, the developers of cotton harvesting machines found remarkably little to draw on in the machines developed for other crops.¹⁴

13. Horine, "Farming by Machinery," 269-75.

14. A minor qualification may be made to note the influence of the corn harvester, the slanted snapping rolls of which were employed in the first attempt by engineers

In the other stages of production aside from harvesting it was, of course, more feasible to apply the experience gained in other crops to cotton. In land preparation, planting, and cultivating many recent refinements in the basic tools—plows, harrows, lister planters, cultivators, and rotary hoes—have a general usefulness which could be applied to cotton once the process of mechanization on southern farms had reached the stage at which tractor power was generally available. Often, as we shall see, this condition came about indirectly, through the initial application of tractor methods to another crop, such as sorghum, in a mixed farming enterprise. But the significant thing to note about the retarded way in which even partial mechanization entered the Cotton Belt was the explosive possibility that as soon as the solution of the key problem, the mechanical harvesting of cotton, was in sight, it opened the way for a tremendous acceleration of mechanization in all aspects of the crop. That is to say, a fund of unapplied but potentially applicable experience was on tap even though borrowing had been of little help with the primary technical problem.

In thus generalizing about the technical factors affecting the rate of mechanization, two circumstances should not be overlooked:

(1) Special local conditions may seriously influence the applicability of certain machines so that total mechanization is there for a time delayed. For example, the rotary hoe, which works as well in dry, loose soils in the cotton region as it does in those of the Corn Belt, is not nearly so effective in wet, heavy soils, and thus leaves the weed control problem still unsolved in some important areas.

(2) Partial mechanization has sometimes proceeded a considerable distance without the solution of what we have called the "key" problem—mechanical harvesting—if the institutional organization of the farm enterprise did not demand that a solution of this problem come first. In the western portion of the Cotton Belt, where the crop had long been hand picked with migrant labor, the farm operator could afford to reduce costs on the other stages of production by introducing partial mechanization, since he had no year-round responsibility to his harvest labor force. In the Mid-South and the Southeast, on the other hand, the tendency of many operators has been to wait until

to construct a cotton stripper in 1927. Eventually this principle was incorporated into the present-day stripper, but in considerably modified form. D. L. Jones, W. M. Hurst, and D. Scoates, *Mechanical Harvesting of Cotton in Northwest Texas* (Texas Agricultural Experiment Station, Circular 52, College Station, November, 1928), 14-15.

total mechanization is an assured fact before they begin tractor farming even in those operations where the tractor is technically efficient. This is because the secondary bottleneck of weed control looms almost as importantly in their minds as the primary one of harvesting. Under the sharecropper system, where it persists, mechanizing the harvest would not in itself relieve the need to maintain a considerable resident labor force, unless chopping (thinning to a stand) and hoe cultivation were simultaneously provided with dependable mechanical alternatives. So long as wages are relatively low, the introduction of any power farming at all has seemed to some operators to demand an irreversible plunge into total mechanization—a plunge that available capital resources might not permit. A number of operators, as we shall see in Chapter 11, are seeking to devise transitional labor supply arrangements which will protect them from total commitment to mechanization until they are sure that it provides year-in and year-out solutions to the requirements of varying crop seasons.

Thus the technical, as well as economic, problem of mechanizing cotton production has been that the process must proceed simultaneously on several fronts. A solution of the mechanical harvesting problem has demanded not only collateral improvements in varieties grown, cultural practices, defoliation measures, and ginning methods, but a fairly complex solution of the thinning and cultivating problems. The interesting and significant thing is that currently for perhaps the first time the cotton economy is securing the benefit of cumulative, mutually reinforcing technical developments such as have occurred previously in other agricultural regions, and the only question which remains is whether the prevailing institutions will permit these forces to take full effect.

CHAPTER 6

Mechanizing the Harvest

THE SUCCESSFUL SOLUTION of the problem of devising a mechanical harvester was not delayed for lack of ingenuity and painstaking investigation on the part of aspiring inventors. The possibility of reducing the labor involved in picking cotton challenged the imagination of countless individuals. Some of them devoted years of unrewarded effort to the task under most unpromising conditions.

A few abortive attempts to design a mechanical picker or harvester were recorded as early as the decade before the Civil War, among which we have noted the issuance of the first patent in September, 1850, on Rembert and Prescott's picking machine.¹ By 1864 there were twelve patents in effect on a variety of manual or mechanical picking aids, and in nearly every succeeding year at least one patent has been granted for some kind of harvesting device. Over 1,800 patents had been granted on new or improved machines by the end of World War II, when a commercial market for these machines first began to develop.

Most of the inventions which have been patented may be grouped within six broad classifications, from among which two basic types of

1. See J. L. Watkins, *King Cotton: A Historical and Statistical Review, 1790-1908* (New York: J. L. Watkins and Sons, 1908), 149, 175, 259, for descriptions of some of the earliest inventions.

harvesters in current use have emerged. The six classes of inventions are (1) pneumatic machines, (2) threshing machines, (3) chemical processes, (4) electrical machines, (5) stripping machines, and (6) spindle pickers.²

PNEUMATIC MACHINES

These machines, which have from time to time attracted considerable notice, were designed to extract the lint cotton from the boll by means either of a vacuum suction or a blast of air. The first patent on this type of picker was granted in 1859, and most of the subsequent efforts went into attempts to design a nozzle which would suck (or blow) and convey the tight-fitting locks of cotton from the burr satisfactorily. The machines have generally consisted of a vacuum tank with attached hoses that a crew of operators would apply to the individual bolls. The opening of a valve caused the cotton to be drawn through the hose into the tank.³ A small amount of cotton was actually picked with a machine of this type in the Imperial Valley of California during the labor crisis of 1918.

In 1922 the International Harvester Company became interested in developing a pneumatic picker and over a period of years investigated both the suction and air-blast methods of extraction. A machine built during the summer of 1924 consisted of a large diaphragm vacuum pump driven by an eight-horsepower gasoline engine. It was mounted on a light two-wheel cart drawn by a mule. The cotton was drawn from the bolls by four manually directed hoses and conveyed to a large bag at the rear of the cart.

2. The classifications and descriptions followed here are, with some modifications and additions, those of Harris P. Smith, Professor of Agricultural Engineering at the Agricultural and Mechanical College of Texas, who has made an extended study of the history of attempts to mechanize the cotton harvest, with particular attention to the cotton stripper. See H. P. Smith and others, *The Mechanical Harvesting of Cotton* (Texas Agricultural Experiment Station, Bulletin 452, College Station, August, 1932), which contains illustrations of many of the early devices and a list of patents granted on all types of cotton-harvesting equipment from 1850 to 1932.

3. For a description of Thomas B. Hyde's suction picker see "An Improved Cotton Picker," *Scientific American*, LXVII, No. 19 (November 5, 1892), 291. An early self-propelled model powered by a gasoline engine was invented by George A. Lowry. It had eight rather clumsy picker arms, each with an endless chain bearing hooks to extract the cotton, which was then blown into sacks. It was designed to be operated by one man and four boys. William Dale, "A Machine for Picking Cotton," *Scientific American*, XCIV, No. 18 (May 5, 1906), 371-72.

A test conducted near Dallas, Texas, in September, 1924, was described as follows:

One man who was capable of picking from 350 to 400 pounds of cotton per day was started out on a row of cotton and at the same time the pneumatic-type picker with one man handling each of the four nozzles was started down adjoining rows. At the end of three-quarters of an hour the hand picker was fifty yards ahead of the machine. In other words, he had picked about 25 percent greater distance than each of the men handling a nozzle, had a great deal cleaner sample in his bag and had picked the cotton cleaner from the stalk.

This test thoroughly convinced the management that to be practical the human element had to be entirely eliminated from cotton harvesting machines. The human wrist is like a universal joint and can adapt itself to almost any position when reaching for cotton, whereas the hose and nozzle are more cumbersome and unwieldy to direct against a cotton boll. This type of machine could have only one possible advantage and that would be to increase the amount of cotton that an unskilled picker could gather.⁴

The company thereafter concentrated on other approaches to the problem.

Efforts by others to devise a successful pneumatic picker continued well into the thirties. W. C. Durant, the automobile manufacturer, produced a light gasoline-powered machine weighing only three hundred pounds which employed a set of rotary blades, as well as suction, in the picker-heads. His firm in St. Louis built some five hundred of these machines, but was unable to dispose of them in this country and in time sold most of them to the Soviet government, which during the thirties displayed an active interest in American efforts to mechanize cotton harvesting.⁵

COTTON THRESHING MACHINES

The idea occurred to a number of inventors, possibly suggested by the successful harvester-thresher combines used in other crops, to con-

4. From the unpublished files of the International Harvester Company.

5. "New Mechanical Cotton Picker," *Literary Digest*, CIII, No. 7 (November 16, 1929), 32; Robert Kenneth Straus, "Enter the Cotton Picker," *Harper's*, 173 (September, 1936), 389. The Thurman suction picker, which was tried out with considerable publicity at Wichita Falls, Texas, in 1922, is described in "Cotton Picking by Suction," *Literary Digest*, LXXVIII, No. 5 (August 4, 1923), 29; and the Nisbet machine, which combined an air blast with a double set of mesh rollers, in F. D. McHugh, "Machines Pick Cotton, But—," *Scientific American*, 159, No. 4 (November, 1938), 242-45.

struct a machine which would cut the entire cotton stalk and separate the lint from the rest of the plant by threshing action. Such a machine would necessarily have to be rather large and complicated in order to handle the massive bulk of the cotton plant along with the lint. A machine of this type was patented in 1886, but its performance was evidently not remarkable enough to record.

In 1925 the International Harvester Company experimented with a machine patterned after a grain separator. It was designed to pull the entire boll off the plant and separate out the cotton. It was soon abandoned because it took the mature and immature bolls indiscriminately and did not separate the lint effectively.

CHEMICAL PROCESSES OF PRODUCTION

Proposals to utilize the entire cotton plant by some process of chemical digestion, thus obviating the need to extract the lint cotton from the boll, have been made recurrently. Robert R. Roberts of Washington, D. C., who pioneered in the development of delinted seed, in 1906 announced that the cotton stalk could be pulped and made into paper, but since this would have greatly reduced the value of the product, there was little interest in the suggestion.⁶

Probably the most extensive experiments were made by Dr. Frank K. Cameron of the University of North Carolina, who proposed to substitute the entire cotton plant for wood pulp as a basic source of cellulose in the manufacture of rayon.⁷ He suggested that the cotton plants be thickly sown, mown and baled by machine like hay, and then dried and powdered. The oil contained in the seeds was to be removed by the use of a solvent, and the remainder of the plant chemically digested into alpha cellulose. After a number of years of experimentation Dr. Cameron claimed that his process was a laboratory success, but the need for a substitute for wood pulp was evidently not pressing enough during the thirties to insure funds for its development, and

6. "Utilization of the Entire Cotton Plant," *Scientific American*, XCV, No. 19 (November 10, 1906), 343.

7. "Cotton Mown Like Hay and Chemically Digested," *Science*, LXXXIII (New Series), No. 2160, supp. (May 22, 1936), 10; Alfred R. Macormac, "Utilization of the Whole Cotton Plant," *Scientific Monthly*, XLIII (September, 1936), 285-86; "Scientia Omnia Vincit; Experiments in Turning the Whole Cotton Plant into Rayon," *Scientific American*, 163, No. 5 (November, 1940), 243.

the method did not become commercially practicable. The mere suggestion that the process of cotton production might thus be radically transformed was enough, however, to cause serious anxiety to a number of producers during the depression years. News stories concerning proposals for "cotton shipped in tank cars" fed this anxiety. It was feared that the introduction of the new method would seriously disturb existing relations of production and might introduce a severely competitive factor into an already depressed enterprise.

ELECTRICAL MACHINES

As early as 1868 a Brooklyn, New York, inventor patented a machine which sought to apply the principle of electrical attraction to detach the fiber from the boll and to convey it, by means of a statically charged belt, to a receiving box. Others later tried to apply the same principle, all without success, since an electrical charge proved insufficient to pull the cotton from the boll.

An application of electricity on an entirely different principle sought to utilize its recognized flexibility of motive power in a picking machine. One of the most persistent experimenters was L. C. Stuckenberg of Memphis, who announced in 1922 that after fourteen years of work he had successfully combined a vacuum machine with a set of electrically operated brushes revolving inwardly at the end of each suction tube.⁸ The operation of the brushes was said to have suggested itself to Stuckenberg one day when he observed a cow which had broken into a cotton field adroitly extract the fiber with her horny tongue in order to obtain the tasty oilseeds. His picking apparatus was mounted on a gasoline tractor, which provided power for eight electric motors required to drive four sets of picking brushes and four suction and cleaning fans. This rather elaborate machine was also doomed to failure, since the electrically operated brushes added little to its performance, and more especially because the machine had the same disadvantage as other pneumatic machines—it did not result in a sufficient saving of hand labor. Stuckenberg spent a good many more years trying to simplify his machine, to no avail.

8. "The Successful Cotton Picker," *Scientific American*, 126, No. 3 (March, 1922), 179; M. Tevis, "The Electrical Cotton-Picker," *St. Nicholas*, XLIX (April, 1922), 655-57.

STRIPPING MACHINES

Cotton strippers, also known in some of their early forms as cotton sleds or "sledders," are designed to remove the cotton, burr and all, from the stalk by combing the plant either with extended teeth or by drawing it between stationary slots, revolving rolls, or brushes. A patent for a rather simple invention of this kind was granted to John Hughes of New Berne, North Carolina, on March 28, 1871. The following year Z. B. Sims of Bonham, Texas, patented a sled with projecting fingers for the same purpose. A somewhat more complicated and skillfully constructed model appeared in 1874, when W. H. Pedrick, of Richmond, Indiana, patented a stripper which employed two revolving rolls studded with teeth to pull the ripe cotton from the plants. The purpose of the movable rolls was to avoid unnecessary injury to the plants or to the unopened bolls.

Despite the fact that these machines closely resembled in principle some that later came into use, they were long neglected because it was felt that they were too wasteful in the proportion of the cotton which they failed to harvest and in the seriously deteriorating effect which they had on the grade of the product.

The idea of mechanically stripping cotton was reintroduced into the Texas Panhandle in 1914, when a bumper crop coincided with prices so low that the cost of hand picking could not be covered. Several farmers in desperation harvested their cotton by dragging it with a section of ordinary picket fence tied to a team. This makeshift method resulted in cotton so full of trash and unopened bolls that it was refused at the gin. Thereupon these farmers, undaunted, took their cotton to a grain thresher and had it threshed! The threshing process broke open the unripe bolls and removed some of the trash, after which it was possible for the gin to handle it more satisfactorily. At best, the resulting product must have been of rather low grade, and stripping for some time thereafter was utilized only as a last resort.

Nevertheless, because the cotton grown in this area is subject to early frost and was often pulled or snapped in the boll by hand, growers demanded that the ginner develop methods of handling immature or "bollie" cotton. Consequently gins were redesigned to include more effective cleaning and burr-extracting devices than were found in most parts of the Cotton Belt.

In 1926 there was another critical season in the High Plains. The crop was unusually large, prices fell abruptly, labor for hand harvesting was scarce and expensive, and the weather was unfavorable for picking by hand. Farmers were again compelled to take unusual measures to save the crop. Many of them built their own sleds, employing a variety of original designs with the assistance of the local blacksmiths; and cotton stripping received its first extensive trial. The home-made devices were of two sorts: a wooden box mounted on runners with a set of steel fingers projecting at the front, or a similar box with a notched throat and a narrow slot to catch and strip the plant. They were horse- or mule-drawn, and some were built to strip four rows of very small cotton at a time. Crude as these strippers were, they cost only about \$9 to \$27 to build and would harvest about four or five acres a day at a cost estimated at \$2.78 a bale.⁹

By this time the improved gins were able to process the cotton, and it was reported that the mechanically stripped cotton actually produced a better sample than cotton that was hand-stripped because the additional handling before it reached the gin removed much of the dirt.

As a result of the extensive use of homemade contrivances in the Lubbock area during the 1926 season, several implement manufacturers became interested in developing cotton stripping machines and the following year a number of commercial strippers appeared on the market. Nearly all of these were of the slot rather than the finger type, and it was this type, modified by the use of revolving rolls as in Pedrick's early design, which proved to be the most satisfactory. The firm which displayed the greatest interest in improving and promoting the use of the stripper was Deere and Company, which tested an experimental double roll stripper at Plainview, Texas, in 1927. In 1930 this company manufactured fifty mule-drawn strippers, five one-row tractor-mounted and five two-row tractor-mounted stripper-cleaners.¹⁰ In the succeeding two years the company increased its output until it was producing at the rate of five hundred strippers per year.

Following the onset of the depression, however, interest in the de-

9. L. P. Gabbard and F. R. Jones, *Large-Scale Cotton Production in Texas* (Texas Agricultural Experiment Station, Bulletin 362, College Station, 1927), 21.

10. L. B. Neighbour, "Progress in the Mechanical Stripping of Cotton," *Proceedings of the Second Annual Beltwide Cotton Mechanization Conference*, Lubbock, Texas, October 14-16, 1948. Summary in *AcCo Press*, XXVI, No. 11 (November, 1948), 8.

velopment of mechanical strippers languished on the part of farmers and manufacturers alike. With cotton selling at six cents a pound, wages for hand snapping at thirty cents per hundredweight, and cash extremely scarce, the market for labor-saving devices disappeared. The John Deere strippers were offered for \$185 each on a contract calling for \$25 on delivery and the balance at \$5 for each bale harvested. Even so some dealers eventually disposed of their remaining stock in 1941 at \$15 each.

In the meantime continuous experimentation in stripper design and performance was being carried out by the Texas Agricultural Experiment Station at College Station and at the Lubbock (High Plains) substation. In 1927 the Texas experiment station had begun a study to determine the most effective type of cotton harvester and for three years its engineers experimented with modifications of a horse-drawn stripper supplied by Deere and Company. In 1930 the station built its own tractor-mounted single-row stripper based on the principles worked out by its engineers and in 1935 added a field burr-extractor which was mounted on the rear of the tractor to clean the cotton as it was harvested. This machine has importantly influenced the design of most of the commercial strippers that were later built.

During this period the performance of the machines was raised until they would harvest 98 per cent of the crop in varieties of cotton grown at Lubbock, and 92 to 94 per cent of the taller, bushier cotton grown at College Station.¹¹ When labor shortages began to occur in the High Plains during World War II, the C. E. Morris Company of Dallas obtained permission from the Texas Station to build a two-row tractor-mounted stripper incorporating the improvements worked out as a result of continuous field testing during the prewar years. The company manufactured and sold thirty-five of these machines in 1943. The machine was designed to be attached to a standard all-purpose tractor and sold for \$1,440. It was said to strip seven to ten bales a day. The Morris firm went out of business in 1944, and C. T. Boone of Lubbock thereupon took over the improvement and manufacture of the Texas Station stripper. At least three other manufacturers contributed to the production of about 325 two-row mounted strippers in 1944, and from this time output tended to increase (with the excep-

11. H. P. Smith and others, *Mechanical Harvesting of Cotton as Affected by Varietal Characteristics and Other Factors* (Texas Agricultural Experiment Station, Bulletin 580, College Station, December, 1939), 13-14.

tion of a lag in the late forties) until, by the spring of 1953, it is estimated that over 18,000 strippers were available for that year's harvest (Table 1). Deere and Company, which had sold practically no strippers from 1932 to 1942, was at last able to capitalize on its previous developmental work and became the leading manufacturer with an output of about 4,000 strippers from 1946 to 1948.¹² This company's machine sold for \$905, exclusive of tractor, at Sherman, Texas, in 1948.

Table 1

PRODUCTION OF MECHANICAL COTTON STRIPPERS
IN THE UNITED STATES, 1946-1953

	Stripper-type harvesters manufactured *	Cumulative total
1946 and prior years	1,082	1,082
1947	3,418	4,500
1948	1,664	6,164
1949	300	6,464
1950	1,482	7,946
1951	5,754	13,700
1952	3,325	17,025
1953	2,762	19,787
Estimated reduction by obsolescence through 1952		1,200
Number available for 1953 harvest		18,587

SOURCE: 1946-1950: Estimates prepared by National Cotton Council of America. 1951-53: U.S. Bureau of the Census, *Farm Machines and Equipment. Facts for Industry*, Series M35A (Washington: Bureau of the Census, annual dates, 1951-53).

* Beginning with 1951, figures represent only number of machines manufactured for domestic use.

In 1949 an experimental stripper of new design which had been developed by the Oklahoma Agricultural Experiment Station in co-operation with the U. S. Department of Agriculture was demonstrated in four varieties of Oklahoma cotton.¹³ Instead of a metal stripper roll

12. Gilbert C. Fite, "Recent Progress in the Mechanization of Cotton Production in the United States," *Agricultural History*, 24, No. 1 (January, 1950), 25, 27.

13. The machine is described by its developers in W. J. Oates, R. H. Witt, and W. S. Wood, "The Development of a Brush-type Cotton Harvester," *Agricultural Engineering*, 33, No. 3 (March, 1952), 135-36, 142.

or a set of stripper teeth as in the other strippers in use, it had two revolving fiber brushes which rotated against each other to strip the cotton plant. The first model also had an air conveyor system rather than a mechanical conveyor to carry the cotton from the stripping rolls to the trail wagon. This change was intended to eliminate the losses while turning at the ends of rows which occur with an extended mechanical conveying system. The following year, however, it was found that under certain harvesting conditions an air conveyor was inadequate and it was then redesigned to include a partial mechanical conveyor. The brush stripper has since been demonstrated in other parts of the cotton region and is said to produce cleaner cotton with fewer plants uprooted than strippers using steel rolls. Three manufacturers have built pilot models patterned after the Oklahoma machine and a few machines have been produced commercially.

Another recent variation on the stripping machine is a harvester which employs an endless chain of traveling wire rods to lift the cotton from the plant. It is being manufactured in small quantities by the Harrington Manufacturing Company of Lewiston, North Carolina.

Farmer use of the stripper type of machine has been largely confined to the High Plains and the Rolling Plains of Texas and Oklahoma, since it appears to be best adapted to harvesting cotton grown under the rather exceptional climatic conditions which prevail in those areas. About 40 per cent of the record 1949 crop in the High Plains was harvested by stripper. Because some farmers preferred to have their cotton snapped by hand and then scrapped by machine, it is probable that 60 per cent of the cotton acreage in this area was actually covered by machine in order to harvest 40 per cent of the crop.¹⁴ A good deal of custom harvesting for others was done by farmers who had already harvested their own crop.

The percentage of the crop harvested wholly or partly by machine will probably vary from year to year, according to the availability and cost of hand labor. At wage rates prevailing in 1947, 1948, and 1949, it was generally more profitable for operators with as many as 150 acres in cotton to harvest their crop by machine rather than by hand, even at the cost of a somewhat lower yield and grade.

Several additional factors promise to encourage the increased use

14. M. N. Williamson, Jr., Q. M. Morgan, and Ralph H. Rogers, *Economics of Mechanical Cotton Harvesting in the High Plains Cotton Area of Texas* (Texas Agricultural Experiment Station, Bulletin 735, College Station, June, 1951), 11-12.

of mechanical harvesters in this area. As growers have become more experienced in stripper operation, machine-harvested cotton has improved in freedom from trash and dirt. Improvements in the machines themselves are still being made by manufacturers, and local dealers have increased their supplies of repair parts. Ginners have installed special equipment to accommodate machine-harvested cotton. Plant breeders are engaged in developing varieties of storm-resistant cotton better adapted to stripping. Other lines of research are being explored simultaneously. Mechanical harvesting has so far usually had to wait until frost has stripped the leaves from the plants, but if a dependable chemical defoliant can be developed, cotton can be harvested earlier and this will materially reduce the waste and grade loss due to weathering in the field.

The possibility that cotton strippers may be successfully adapted for use in more humid portions of the Cotton Belt will be considered in Chapter 8.

SPINDLE PICKERS

Inventions in this group have included a multiplicity of cotton harvesters designed to pick the open cotton from the bolls by means of spindles, fingers, or prongs. The aim has been to construct a machine that could be used for repeated pickings during a season without material injury to the unopened bolls and the foliage necessary for continued growth. As mentioned before, from the time of Rembert and Prescott's early invention in 1850 until the nineties very little progress was made in developing such a machine. About this time Angus Campbell, a Chicago inventor who had been trying to perfect a spindle picker since 1885, began to work out the essential mechanical principles for a machine that would pass a series of rotating spindles through a cotton plant and twist the loose fiber from the bolls. He took out his first patent in 1895, and in 1901 he patented a horse-drawn machine which carried two rows of intermeshing spindles projecting horizontally into the cotton plant from each side.

Campbell's persistence and personal sacrifice in his efforts to perfect his machine over a period of thirty-seven years deserve comment in this chronicle.¹⁵ He came to this country from Scotland in search of a

15. The ensuing account is based in part on the following sources: Arthur W. Page, "A Cotton Harvester at Last," *World's Work*, XXI (December, 1910), 13,748-60; William Day, "Picking Cotton by Machine," *Scientific American*, CIV, No. 9 (March 4, 1911), 231; "A Machine that is Philanthropist," *Outlook*, 97 (March 4, 1911), 484-85.

career as an engineer and inventor and lived for a time in Texas, where he observed what seemed to him a needless waste of manpower in the harvesting of cotton. After he found employment as a pattern maker in the experimental department of the Deering Harvester Company at Chicago, he determined on his own initiative to develop a cotton picker. Each harvest season for over twenty years he would use his annual vacation time to journey to Texas, Louisiana, or Mississippi, where he would try out his latest model, only to find that it needed further improvement. In 1910 he was so confident of success that he put five machines into the field in a widely publicized demonstration at Waxahatchie, Texas, but evidently his optimism was premature.

Up to this time he had constructed and tried out some fifty-five designs and major modifications. Because of the distance from Chicago to the cotton region and his limited time he could make only one brief series of tests each year, and he was further hampered by the circumstance that there were no nearby shop facilities in the test areas which he could use to make design changes on the spot.

In 1910 Campbell joined forces with Theodore H. Price, who had independently devised a spindle picker which he patented in 1904. The Price-Campbell cotton picker was patented in 1912 and underwent continuous testing and improvement until Campbell's death in 1922. The results, however, were never satisfactory. The machine was complicated in construction and expensive to build. It left too much cotton on the plant or knocked to the ground, in addition to which it injured the unripened bolls. Neither of the two companies which Campbell organized to promote his inventions was financially successful.

Notwithstanding these failures, the extensive trials that Campbell conducted and the mechanical principles he worked out formed an invaluable basis for later experimentation and improvement by others. The Price-Campbell patents were taken over by the International Harvester Company in 1924, and although another quarter-century of testing and modification was required, the basic ideas which they embraced contributed to the ultimate success of the machine placed on the market by that company in 1948.

Several other picker-type machines were constructed during the early part of the century. P. P. Haring of Goliad, Texas, as early as 1897 began to acquire a series of patents on a rather intricate horse-drawn device. It utilized revolving corkscrew prongs attached to cylindrical picker arms. These arms were mounted in turn on vertical

shafts which traveled backward at the same rate of speed as the machine traveled forward.¹⁶ The prongs rotated while in contact with the cotton so as to extract the lint and then reversed themselves to release the fiber onto a conveyor belt. Similarly elaborate machines which combined complicated mechanical picking devices with suction conveyors and cleaners were patented by B. Johnson of Temple, Texas, from 1912 to 1918, and by George R. Meyercord of Chicago somewhat later. These machines were unduly expensive in construction, and none of them performed well enough to justify further development.

John F. Appleby, the widely known inventor of the self-knotting grain binder, tried his hand at inventing a cotton harvester while associated with William Deering during the early part of the century. He took out thirteen patents covering a variety of harvesting principles, including mechanical stripping and a method employing a flail to beat the cotton from the plant. His most successful contrivance was a two-row spindle picker patented in 1913. His first model, patented in 1905, had a drum of spindles mounted horizontally so that the spindles would project downward through the cotton plants as the machine passed over them. In later versions the drums rotated in a vertical position and incorporated an ingenious cam arrangement to insure that the spindles would enter and withdraw from the cotton plant without destructive raking action. It is reported that a few of the Appleby machines were distributed in upland cotton areas and achieved some success under actual field conditions. Yet their chief importance was in helping to influence the design of later machines.

Hiram N. Berry of Greenville, Mississippi, whose first patent on a spindle picker was granted in 1923, demonstrated in the winter of 1926 a self-propelled model whose picker unit was suspended from a high-clearance chassis and driven by an automobile engine. A later model was mounted on pneumatic automobile tires. Until his death Hiram Berry and his son, Charles R. Berry, continued to experiment with this machine. These were the depression years when there was little commercial interest in such a machine and financing was difficult to secure. In 1943, when it began to look as if an actual market for spindle pickers would emerge, Deere and Company bought

16. "Machine that Picks Cotton Without Injuring the Plant," *Scientific American*, CXIV, No. 22 (May 27, 1916), 551, 564. This article apparently refers to an improved experimental model of the Haring machine.

the Berry patents and employed Charles R. Berry to develop the machine under its auspices.¹⁷ The company was primarily interested in Charles Berry's design, patented in December, 1940, for a picker employing spindle columns and stripper columns mounted on chain and sprockets. Development of this design was carried on from November, 1943, until March, 1946, when field tests failed to indicate commercial possibilities. A new line of development was then undertaken which culminated in the company's current spindle picker.

The International Harvester Picker

The most extensive effort to devise a cotton harvesting machine was made by the International Harvester Company, which evidenced interest in the problem from the time of its formation in 1902. Drawing on the experience of one of its predecessor companies, the Deering Harvester Company, the implement firm spent forty years in research before it was able to demonstrate a fully satisfactory spindle picker in 1942. The difficulty of the task is further indicated by the estimated \$5,250,000 which the company spent on the development of its machine.

After investigating several other methods, the International Harvester Company in January, 1924, bought the Price-Campbell patents for a machine with barbed rotating spindles. Under the direction of E. A. Johnston, vice president in charge of engineering, and David B. Baker, manager of engineering, there ensued a period of vigorous experimentation to improve the spindle harvester so that it would pick cotton under all conditions.

Between 1924 and 1930 company engineers designed, built and tested in the field seven distinct types of machines, and likewise tested numerous variations in the shape, size, and arrangement of spindles, doffers, and other essential features of the spindle picker. Each year a "cotton picker caravan" started at Brownsville, Texas, in the lower Rio Grande valley and worked its way northward, trying out experimental pickers under the varying conditions of climate, soil, and plant characteristics in Texas, Oklahoma, Arkansas, Mississippi, and Tennessee cotton areas. Each year the caravan would double back to finish the season near El Paso, Texas, where a field of cotton had been

17. "Race for Pickers," *Business Week*, No. 748 (January 1, 1944), 61-62. Cf. "Cotton Picking Machine Operates on New Principle," *Science News Letter*, 48, No. 17 (October 27, 1945), 264.

reserved for the year's final tests. As the caravan progressed modifications and new ideas would be transmitted to the company's northern engineering shops and were often incorporated in an experimental model for trial at El Paso before the season was over.

In 1924 a self-propelled machine employing four picker drums of Price-Campbell design, but with an improved rotary doffer, was given a thorough trial. The machine presented four major difficulties: The spindles entered the plant in such a way as to strip all of the green bolls and most of the green leaves from the plant; the doffing system tended to produce knots of lint because of an accumulation of gum on the spindles; the conveyor system tended to clog up; and the machine was so heavy that it would bog down in muddy fields.

The same year the company tested its vacuum picker for the last time, and in subsequent years it tried out other methods, including an air blast to blow the cotton against a rotating screen, a boll puller and separator, and a combination stripper and cleaner. However, despite the difficulties with the spindle picker, the engineers considered it the most promising device and consequently concentrated their efforts on its development.

With the advent of the Farmall tractor, the spindle picker was redesigned in 1925 as a pull-type machine. The designers hoped to make the harvester an attachment to a general purpose tractor so that the power would be available for other purposes on the farm. The first model was a trail machine with power for two picking drums derived from the wheels. Later the power take-off principle was applied.

The percentage of cotton picked with only two drums was encouraging, but the trail machine proved difficult to keep in the row. It required three men to operate—one to drive the tractor, one to steer the picker, and one to handle the cotton bags as they were filled. Moreover, the tractor wheels brushed considerable quantities of cotton from the stalks before they entered the picker, and the tractor and picker required an excessive amount of space to turn around at the end of the rows. An offset hitch was worked out to eliminate the need for one man, and other modifications were made in the picker to improve its performance.

The company believed it was ready to introduce these trail machines in limited numbers in 1929 and the parts for twenty such machines were nearly completed when the financial collapse of that year abruptly altered the economic outlook. In succeeding years of the deepening

depression it appeared inadvisable to try to introduce a machine intended to replace labor.

Experimentation continued, with the emphasis on simplification of the machine. Angus Campbell's ingenious but complicated system of cam-controlled picker bars was replaced by a simple drum from which the rotating spindles radiated. After several seasons of trial, however, the engineers decided to return to the Campbell method of positioning the spindles in the plant. Spindles radiating from a drum were found to have an undesirable raking action on the plant and did not pick effectively.

Literally hundreds of changes in spindle design were made during the years of experimentation by International Harvester engineers. To pick a high percentage of cotton, spindles must be designed to be aggressive and to have a high affinity for the cotton fibers, but it is equally necessary that the cotton be removed readily and that the spindles be completely clean after doffing so that they can continue to pick efficiently. The early Price-Campbell spindles were relatively long and straight, but because they were hard to doff, shorter spindles with various degrees of taper were designed and tried. Serrations and barbs of every description on the surface of the spindles were also tried. At one stage of design the rotation of the spindles was stopped and reversed in order to assist in doffing. Because of the high speed of spindle rotation this resulted in excessive wear on the actuating mechanism. Ultimately the cumulated experience pointed to the use of a short, tapered, and slightly barbed spindle such as is used in the International Harvester machine today.

In 1933 the company sought to construct a small demountable picker unit which could be attached to a Farmall tractor and thus bring it within the reach of smaller farmers. Yet while development efforts continued throughout the depression decade, the prospects were not propitious. Clarence R. Hagen, International Harvester's chief engineer in charge of cotton pickers, and probably the man among those living with the greatest experience in cotton picker development, relates that during these years,

Considerable opposition to mechanical picking was encountered in the field. Many cotton farmers were very skeptical, and sure that the cotton crop could not be mechanized. At the end of every harvest season we returned with a little more experience and a little more ridicule, for the

average cotton grower believed firmly in the eternal supremacy of the Negro cotton picker.¹⁸

A number of years were yet to intervene before the commercial introduction of a spindle picker was to become feasible.

The Rust Picker

Of all the cotton picking machines announced from time to time, the one which attracted the greatest public attention was that of John D. Rust, who, with the aid of his brother Mack, is generally credited with having developed the first spindle picker to perform successfully in the field. The development of the Rust machine is interesting not only as a technical achievement by two individuals but as a social experiment representing the attempt by the inventor and his brother to forestall the anticipated undesirable social effects of their highly labor-saving invention.

The Rust brothers were sons of a Virginia cotton farmer who had taken up a homestead in Stephens County, Texas, in the seventies.¹⁹ As boys they obtained a direct acquaintance with the wearisome task of picking cotton and talked of inventing a machine to relieve this form of human drudgery. Their parents died when John was sixteen and Mack was eight, and it became necessary to sell the homestead farm. John began an itinerant career as a migrant farm hand and mechanic, traveling through Texas, Oklahoma, and New Mexico. During these wanderings he became interested in the agrarian socialist movement which at that time flourished in the area, and lived for a time as a member of a cooperative coal-mining community in Oklahoma known as the Milton Colony.

While working as a harvest hand in the wheat fields of Kansas following World War I he completed a correspondence course in automotive engineering and mechanical drafting. This was the only formal training he received in the field of engineering. He then obtained a job

18. Clarence R. Hagen, "Twenty-five Years of Cotton Picker Development," *Agricultural Engineering*, 32, No. 11 (November, 1951), 594.

19. For short biographical accounts of the Rust brothers and their philosophy see John Rust, "The Origin and Development of the Cotton Picker," *West Tennessee Historical Society Papers*, VII (1953), 38-56; "Mr. Little Ol' Rust," *Fortune*, XLVI (December, 1952), 150-52, 197-205; Robert Kenneth Straus, "Enter the Cotton Picker," 386-95; and Victor Weybright, "Two Men and Their Machine," *Survey Graphic*, XXV, No. 7 (July, 1936), 432-33.

as designer and superintendent of construction with the Marriage Thresher Company in Kansas City. This enterprise had been newly organized to develop an improved combine, and although it later failed, in the five years that John Rust worked for the company he obtained valuable practical experience in problems of mechanics and design.

He began to devise the principal mechanical features of the spindle cotton picker in 1924 but was defeated at first by the problem of removing the cotton from a metal spindle which was sufficiently barbed or serrated to twist the lint from the boll. According to his own account, it was while lying in bed one night in the spring of 1927 that he remembered how the early morning dew had caused the cotton to cling to his fingers when he had picked cotton as a boy, and he further recalled that his grandmother had always moistened the spindle of her spinning wheel in order to get the cotton to adhere.

"I jumped out of bed," he wrote, "and found some absorbent cotton and a nail for testing. I licked the nail and twirled it in the cotton and found that it would work." ²⁰

Rust thereupon returned to Texas, where he worked out the plans for an experimental model of his machine. The picking unit which he designed embodied an endless belt fitted with vertical rows of moistened smooth spindles that rotated as they entered the cotton plant. The backward movement of the belt was synchronized with the forward motion of the machine, so that the rows of spindles would come into contact with the cotton in a relatively stationary position and thus avoid injury to the plant. As the loaded spindles traveled on their circuit they were stripped clean by pairs of traveling steel ribbons, and the cotton was conveyed to a storage basket. Although his machine subsequently underwent many modifications, the picking principle has been preserved in essentially its original form in machines based on Rust patents currently being marketed by four companies.

Rust's first patent incorporating these ideas was filed in January, 1928, and his first test model was completed that year. At this time he was joined by his brother Mack, who had received a degree in mechanical engineering from the University of Texas and had spent two years in the employ of the General Electric Company at Schenectady. Together they embarked upon a series of developmental trials and improvements. Their financial backing was meager.

20. John Rust, "The Origin and Development of the Cotton Picker," 15.

Within the family and among close friends they were able to raise only about \$5,500 by 1930. They then moved to Louisiana, where the Llano Cooperative Community sponsored their efforts for a time. While there they elicited the interest of Wallace A. Clemmons, operator of the Gulf Radio School in New Orleans, with whose financial assistance they formed the Southern Harvester Company in 1932. By 1936 they had spent some fifty thousand dollars in development work, part of which was raised among humanitarian investors who were interested in the social philosophy which the Rust brothers were attempting to apply in the introduction of their machine.

The Rust machine set a record when it picked a bale of cotton in one day during a test conducted at Waco, Texas, in 1931. Two years later an improved model picked five bales in a single day at the Delta Experiment Station at Stoneville, Mississippi. These tests received little publicity, however, and it was not until the publication and widespread circulation of an article by Oliver Carlson in early 1935 that the invention and its social implications became the subject of intense public discussion.²¹ Another public field trial was held under the auspices of the Delta Experiment Station on August 31, 1936. This demonstration was widely reported in the national press, for it appeared to show conclusively the labor-saving potentialities of the picker and thereby to cast an ominous shadow on future employment prospects in the region.²²

Under rather favorable conditions of dry fields and uniform, high-yield cotton, the machine picked the equivalent of 400 pounds (4/5 bale) of lint cotton in an hour, although there was considerable trash added to the cotton and waste in the rows. This was forty to fifty times the average rate for hand picking. It was clear that improvements would be needed, but there was no doubt that the machine would pick cotton.

Professor W. E. Ayres, assistant director of the station, who had observed the machine in operation since 1933, remarked that he considered the Rust model to be better as a cotton picker than the Model

21. Oliver Carlson, "The Revolution in Cotton," *The American Mercury*, XXXIV, No. 134 (February, 1935), 129-36; reprinted in condensed form in *The Reader's Digest*, 26, No. 155 (March, 1935), 13-16.

22. "Cotton Picker Portents," *Business Week*, No. 366 (September 5, 1936), 15; "Cotton-gin Rival: Rust Cotton Picker," *Literary Digest*, CXXII (September 5, 1936), 45-46; "Rust Brothers' Cotton Picker," *News-Week*, VIII, No. 10 (September 5, 1936), 29; "Picker Problems," *Time*, XXVIII, No. 11 (September 14, 1936), 47-48, 50.

T Ford was as an automobile when it was first introduced. Edward H. Crump, Democratic National Committeeman and political boss of Memphis, urged the passage of a law to prevent the use of the picker in Tennessee.

As socially minded individuals with an intense sympathy for the impoverished cotton farmers whom they saw around them, the Rust brothers were now faced with a perplexing set of problems. They were eager to see their machine put to use, but they did not wish to be responsible for encouraging the trend toward large-scale mechanized farming at the expense of small farmers. They were afraid widespread labor displacement would result if the sale of their machine were unrestricted. As John Rust put it,

We got down on our knees and picked cotton when we were boys. We decided then that we would try to invent a machine that would do this back-breaking toil. We have that machine. It will do the work of 50 to 100 men. Thrown on the market in the manner of past inventions, it would mean, in the share-cropped country, that 75 percent of the labor population would be thrown out of employment. We are not willing that this should happen. How can we prevent it? ²³

The Rust brothers recognized that in order for the pickers to be produced at low unit costs they would have to be manufactured under conditions of mass production. They were unwilling, however, to allow an established implement manufacturer to produce and distribute them for fear they would lose control over the introduction of the invention. On the other hand, if their picker were held off the market indefinitely, they realized that commercial producers would have a strong incentive to develop a competing machine which might come into use and create the very effects about which they were concerned. They resorted to one plan after another in an effort to resolve these dilemmas.

One approach was the attempt to adapt the machine from the outset to the means of the ordinary small farmer. Although in its most effective version the cotton harvester was a large double-picker-unit machine mounted on a high clearance chassis with a built-in tractor engine, the Rusts spent several years trying to perfect a "Universal Pull Model" that would sell for less than \$1,000 and that could be drawn by a small all-purpose tractor with a power take-off arrange-

23. "Program for Picker," *Time*, XXVII, No. 12 (March 23, 1936), 60.

ment. (A very early model was horse-drawn, with power for the picker unit derived from the ground wheels.) They thereby hoped to reverse the usual sequence of farm machine introduction, in which the larger models tend to appear first for sale to the better capitalized producers (who thus pay a large share of the developmental costs), and then are followed by smaller models designed to reach a broader market. However, none of the early Rust pull models proved mechanically practicable.

Another proposal was to market the machines only under restricted conditions. The plan was not to sell the machines outright but to lease them, and only to those farm operators who would agree to maintain minimum wages and maximum working hours on their farms, and who would give up the use of child labor. Compliance with these conditions would have been exceedingly difficult to secure under the economic pressures of the time. Few planters were willing to provide such guarantees in return for the doubtful advantages of mechanical harvesting.

Community farming projects organized as cooperatives aroused considerable interest during the thirties. Several had been established under the auspices of the Rural Resettlement Administration and of private religious or humanitarian groups. The Rust brothers made their machine rather freely available to such communities, in the hope that a cooperative pattern would emerge which would make possible the collective ownership and operation of farm machines too large and expensive for widespread individual ownership. One of these communities was the Delta Cooperative Farm, organized at Hillhouse (later Rochdale), Mississippi, with funds raised by Sherwood Eddy, a widely known writer and speaker, and directed by Sam Franklin, a former missionary to Japan who was deeply interested in self-help co-operatives.

The farm initially served as a haven for dispossessed sharecroppers, among whom were members of the Southern Tenant Farmers Union who had been forced to flee from their farms after a demonstration against low wages at Marked Tree, Arkansas, in 1936. The project was subjected to intense local hostility because it sought to operate without racial distinctions between its white and Negro members. Because of its limited resources it never achieved an adequate economic base on which to support the number of families who had to be accommodated. Although the Rust picker was extensively tried out on the

Delta Cooperative Farm, under the circumstances the need for a labor-saving device such as the cotton picker was the least of the cooperative's problems; and this tended to be true of the other communities where the picker was demonstrated.

Two of the ten machines which had been constructed by 1936 were sold to the Amtorg Trading Corporation for trial in the Turkestan region of the Soviet Union and possible Soviet manufacture. John Rust made a trip there to supervise their introduction in the belief that they would be used "to lighten man's burden rather than to make a profit at the expense of the workers."²⁴ Demonstration models were also sold in Argentina and Australia about this time.

By the latter part of 1937 the Rust brothers had abandoned their leasing plan and announced that they would sell their two-row, self-propelled models on the open market for \$4,800. Capital for the further development and manufacture of the machines had not been forthcoming under the former plan. At the same time they announced that they would restrict their share in the returns to an amount not to exceed ten times that of their lowest paid employee. Any personal profits remaining would be used to finance a foundation for the purpose of assisting displaced cotton farmers and fostering cooperative farming.

The struggle to secure financing, to improve the machine, and to devise a satisfactory mode of distribution continued during the late thirties and early war years. From time to time announcements were made of plans to form a company with a capitalization of one million dollars to be devoted to the construction of a plant in Memphis. Funds could not be raised, however, and when World War II arrived, temporarily curtailing new construction of this type, the Rust Cotton Picker Company still had only a development shop with no facilities for producing machines in quantity. By 1942 even the shop tools were sold to pay off obligations of the company. The company's charter was revoked and the development of the Rust cotton picker seemed at an end. John and Mack Rust parted company at this time. Mack Rust took

24. Weybright, "Two Men and Their Machine," 433. Despite the intense interest shown by the Soviet government in cotton mechanization developments in this country in the thirties, there is little evidence that mechanical cotton harvesters had come into actual use in the U.S.S.R. before the outbreak of World War II would have made their quantity production unfeasible. See "Cotton Harvest in the U.S.S.R.," *Asia*, XLV, No. 8 (August, 1945), 377.



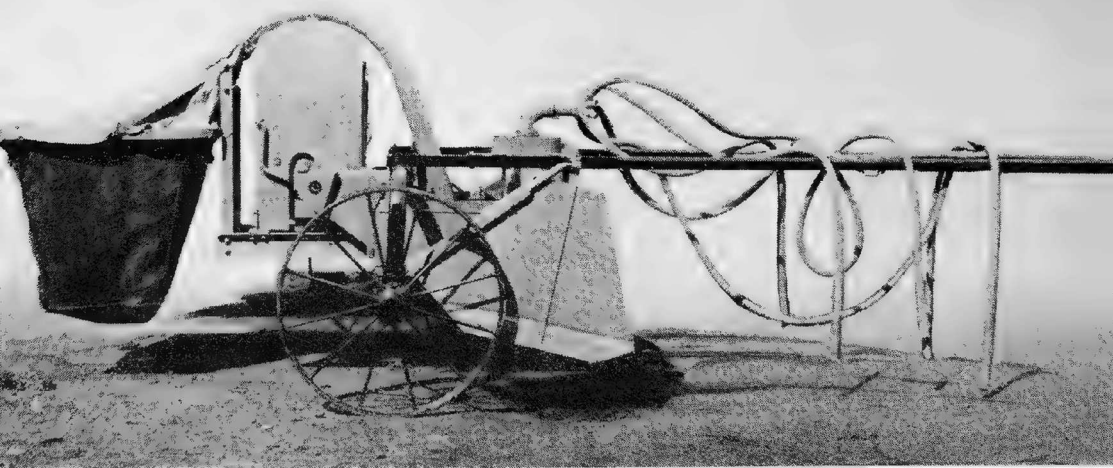
WOOTTEN-MOULTON

Traditional method of cotton culture, using a one-mule walking cultivator to control weeds one-half row at a time.

Hand pickers dragging their heavy cotton sacks through the fields.

USDA PHOTO



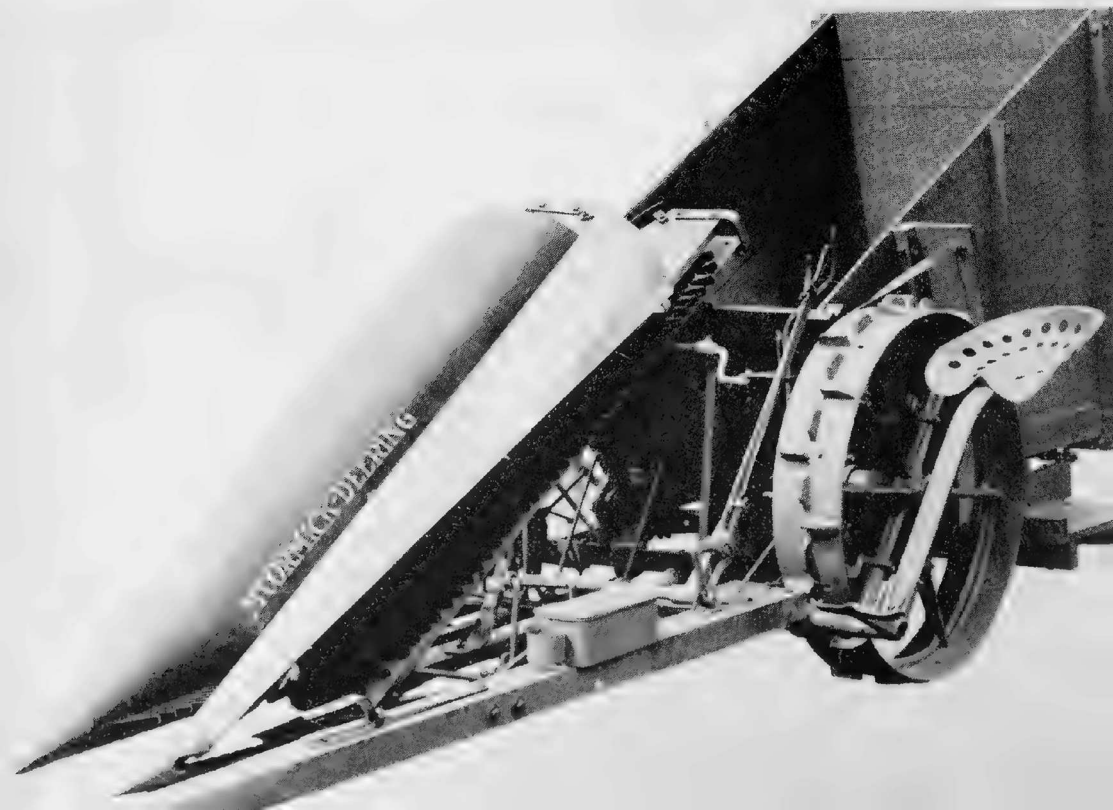


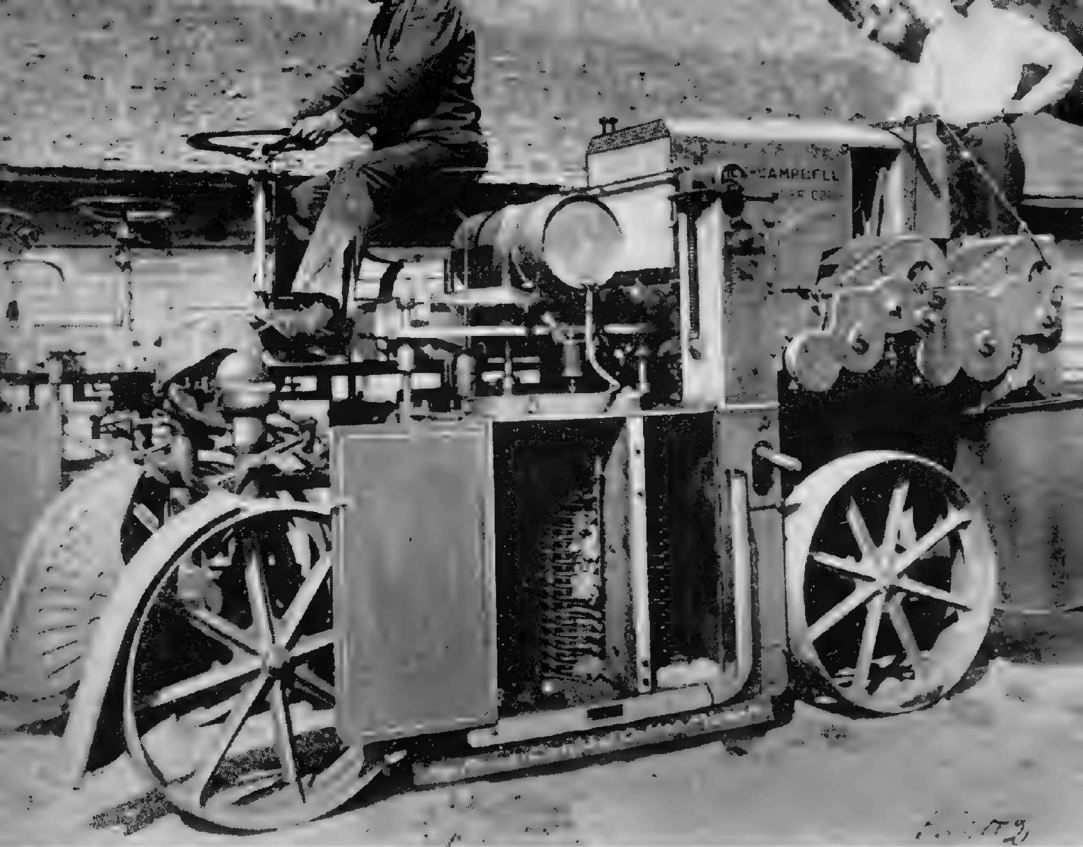
INTERNATIONAL HARVESTER COMPANY

An experimental pneumatic cotton picker tested during the early 1920's. It was mule-drawn and had a gasoline-powered vacuum pump to provide suction for the manually guided picking tubes.

A horse-drawn stripping machine constructed for trial in the High Plains in 1927. This model had moving stripper teeth mounted on an endless chain.

INTERNATIONAL HARVESTER COMPANY



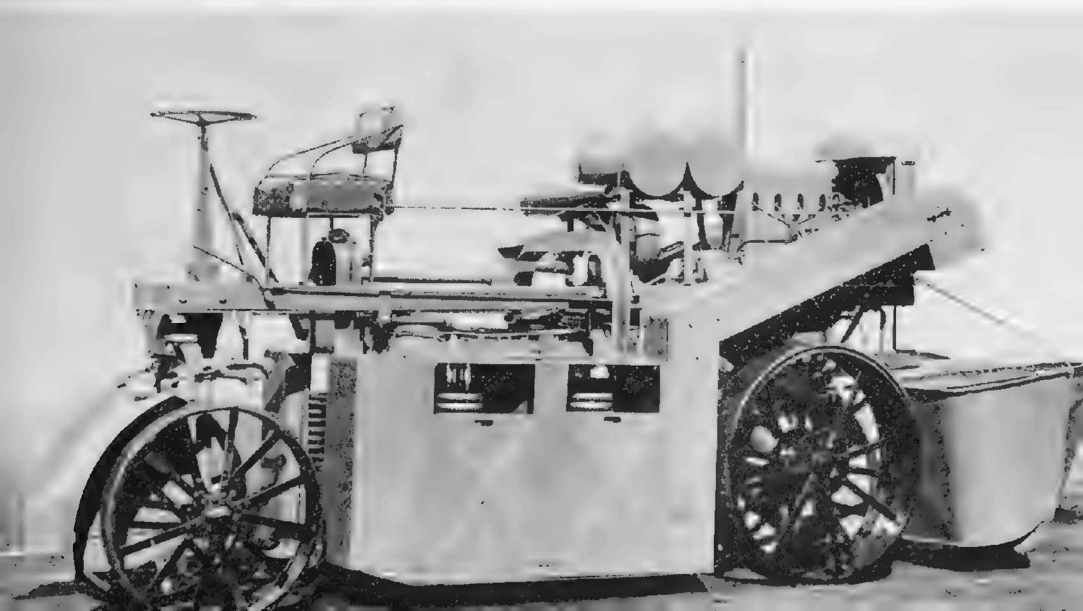


INTERNATIONAL HARVESTER COMPANY

The Price-Campbell spindle picker as it appeared in 1924. A self-propelled machine, it utilized four drums with rotating spindles and stationary doffers to pick from both sides of the row.

An experimental self-propelled picker built by the International Harvester Company in 1924. It was patterned after the Price-Campbell machine but had a number of refinements, including a rotary doffer.

INTERNATIONAL HARVESTER COMPANY





INTERNATIONAL HARVESTER COMPANY

The self-propelled spindle picker invented by Hiram N. Berry and demonstrated in 1926. Later versions of this machine were mounted on pneumatic tires.

A pull-model spindle picker tried out by the International Harvester Company in 1927. Power from the tractor was used to operate the rotating spindles.

INTERNATIONAL HARVESTER COMPANY



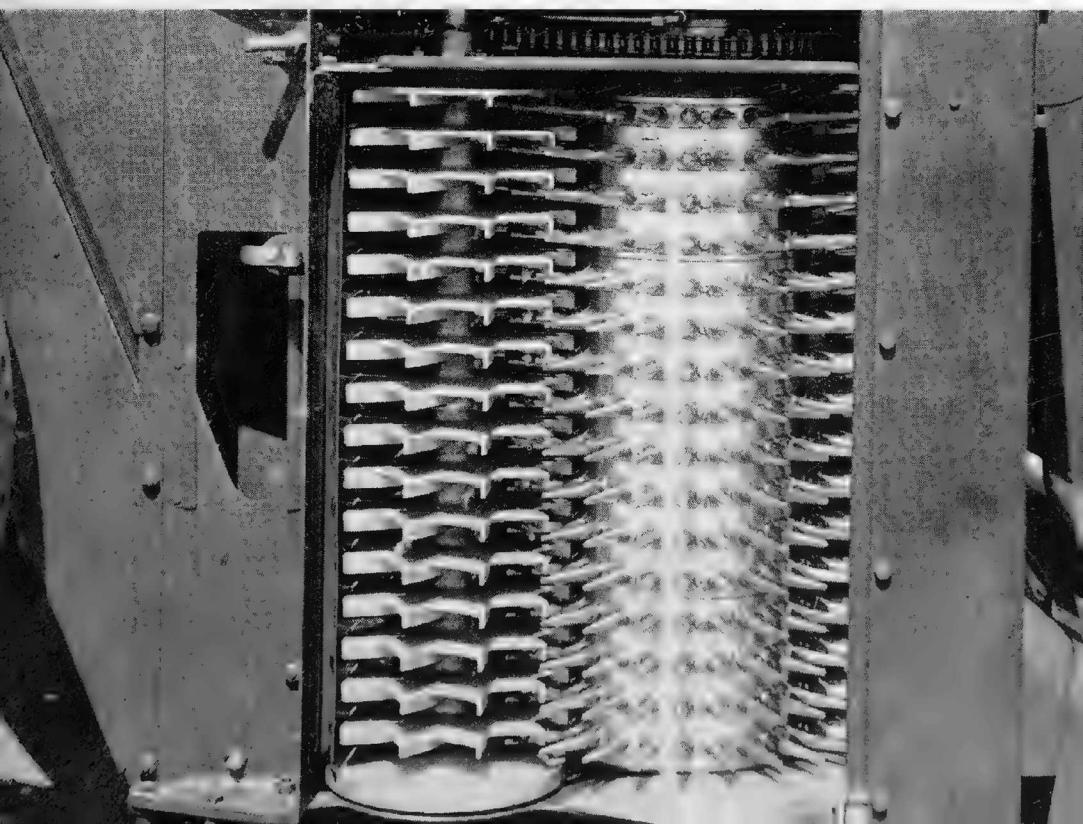


INTERNATIONAL HARVESTER COMPANY

A simplified spindle picker designed for attachment to an all-purpose tractor. This machine was tested by the International Harvester Company in 1929.

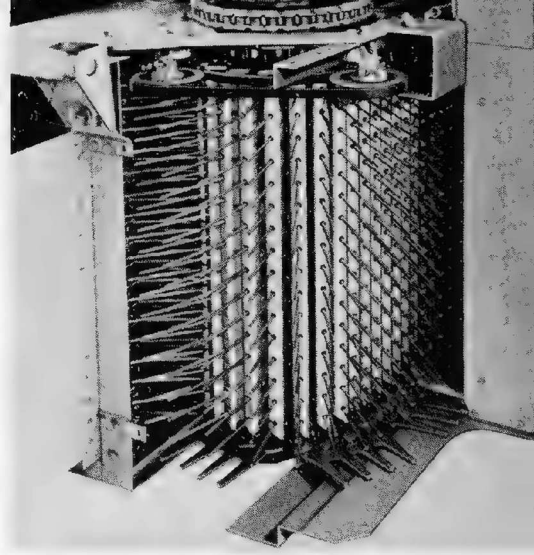
The picker unit of an International Harvester machine as it appeared in 1931. The tapered, barbed spindles and rotary doffers are similar to those in current use, but the radial drum mounting has been replaced by a more efficient cam-actuated mechanism.

INTERNATIONAL HARVESTER COMPANY





THE JOHN RUST COMPANY



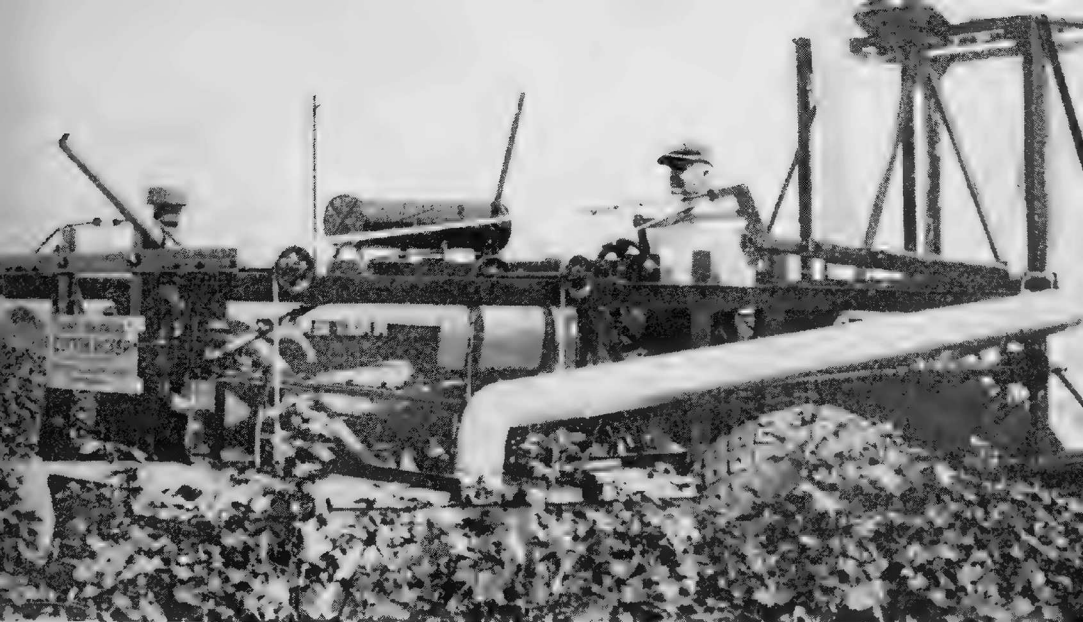
ALLIS-CHALMERS MFG.

Left: John D. Rust with a hand device made in 1927 to demonstrate the basic principle of his invention and to determine spacing for the spindles in the machines he was to build later. *Right:* The present-day picking unit of an Allis-Chalmers harvester employing the Rust principle. Note the long, straight spindles mounted on individual vertical slats.

Mack Rust testing a self-propelled picker built by the Rust brothers in 1928. The machine was powered by a Ford Model T engine.

THE JOHN RUST COMPANY





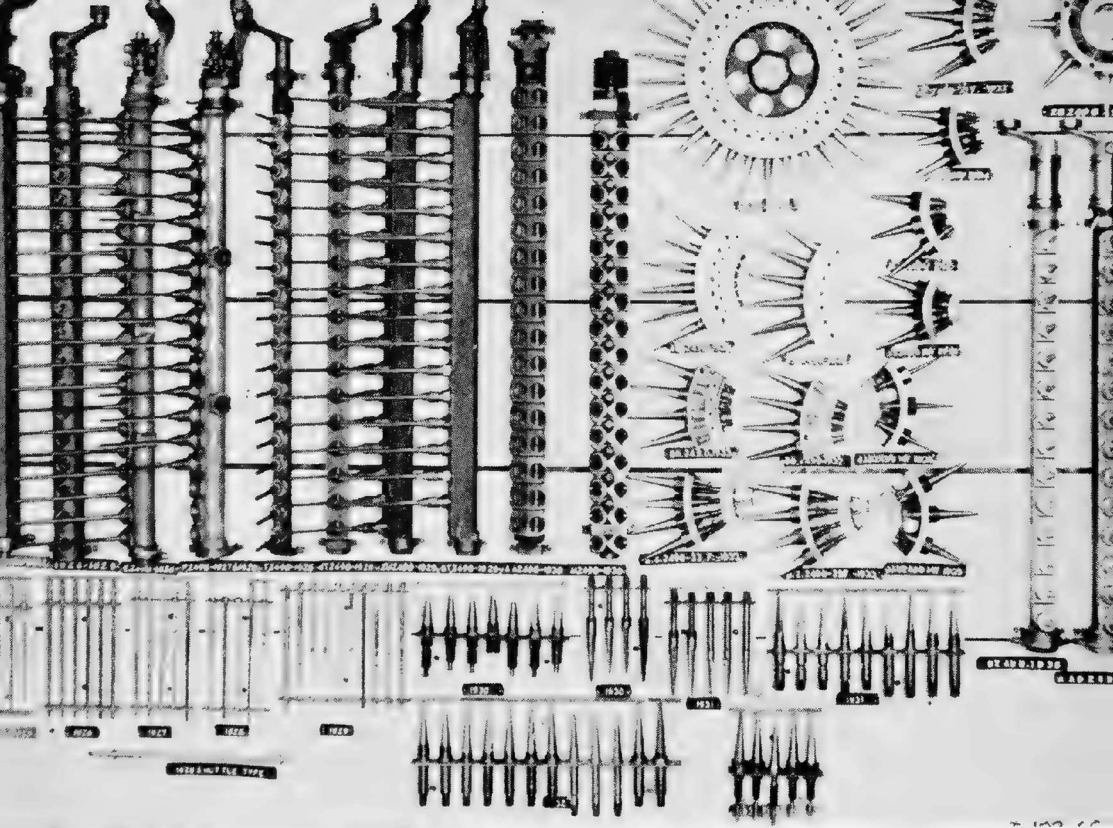
THE JOHN RUST COMPANY

John Rust operating a machine that picked five bales in a single day in 1933. It was necessary, however, to go over each row twice to do a thorough picking job.

A pull-model picker built by the Rust brothers in 1935. They hoped to reduce the cost of the machine and make it available to small farmers.

THE JOHN RUST COMPANY





INTERNATIONAL HARVESTER COMPANY

A display of the many types of spindles and actuating devices experimented with by engineers of the International Harvester Company from 1924 to 1936 before a satisfactory picking mechanism was developed.

The International Harvester high-drum spindle picker which was announced ready for commercial production in 1942. The direction of travel of the tractor unit is reversed.

INTERNATIONAL HARVESTER COMPANY





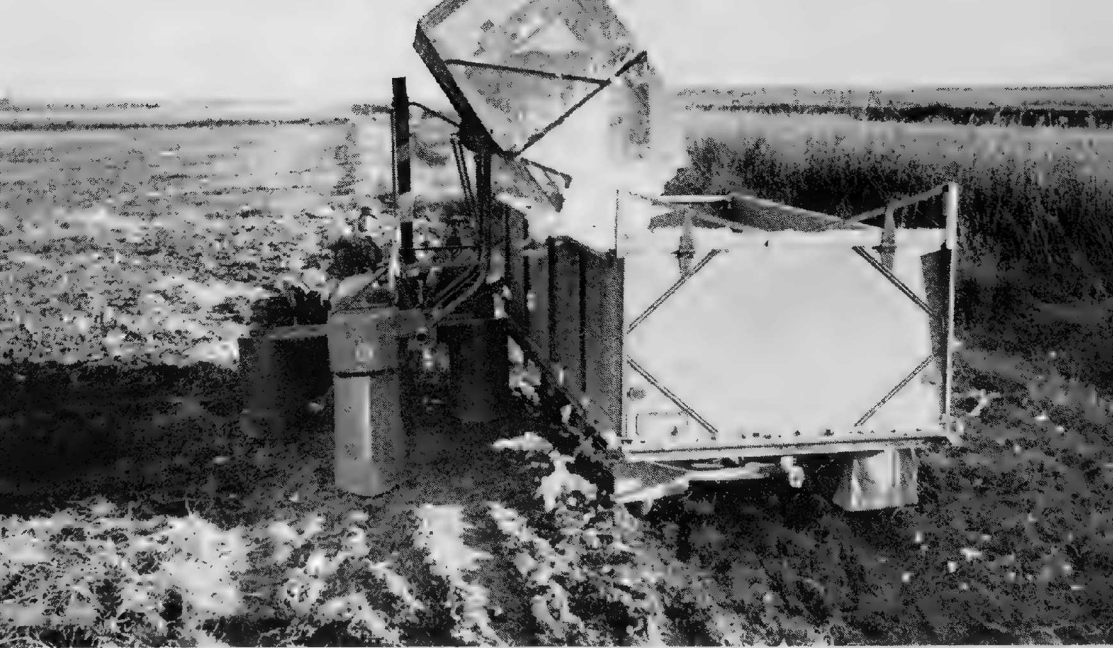
INTERNATIONAL HARVESTER COMPANY

International Harvester's new two-row, high-drum spindle picker. This machine is also made in a low-drum model.

A two-row cotton harvester produced by the Allis-Chalmers Manufacturing Company. The basket tilts hydraulically to unload.

ALLIS-CHALMERS MFG. CO.





ALLIS-CHALMERS MFG. CO.

An Allis-Chalmers single-row cotton picker being unloaded. The picking unit is mounted to the rear of the tractor.

The two-row spindle picker produced by Deere and Company. Four picker drums pick two rows from both sides of each row. The company also manufactures a one-row picker.

DEERE AND COMPANY



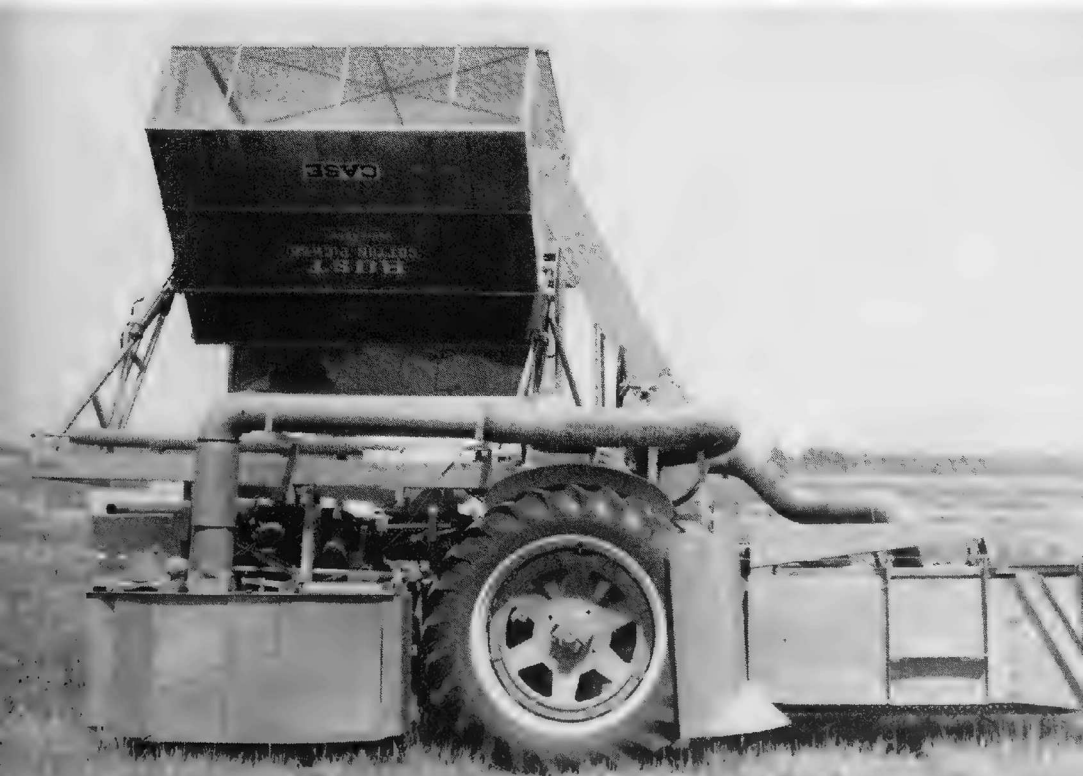


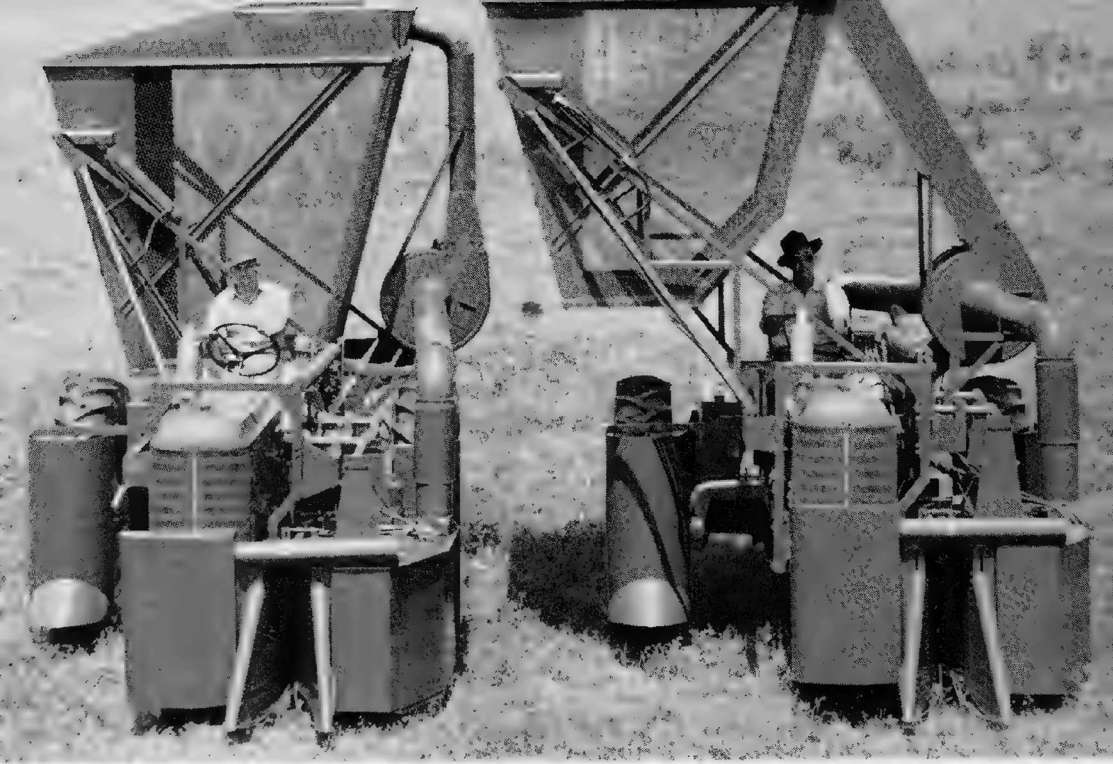
BEN PEARSON, INC.

Rust cotton pickers with tandem picking units manufactured by Ben Pearson, Inc.

A side view of the Rust cotton picker distributed by the J. I. Case Company showing the tandem spindle units which pick the row from each side.

BEN PEARSON, INC.





BEN PEARSON, INC.

Single- and double-unit Rust cotton pickers marketed by Massey-Harris-Ferguson, Inc. The double-unit machine utilizes a tandem arrangement.

A John Deere two-row cotton stripper used in some portions of the Cotton Belt. Only one stripping unit is visible in the photograph.

DEERE AND COMPANY





INTERNATIONAL HARVESTER COMPANY

Complete mechanization of cotton production begins with the disposal of last year's crop residue. A stalk shredder at work.

A four-row drill planter. Seed can be uniformly drilled in the row or hill-dropped with this machine at relatively high tractor speeds.

ALLIS-CHALMERS MFG. CO.





ALLIS-CHALMERS MFG. CO.

Cultivating cotton with a three-row sweep cultivator and side-dressing with fertilizer at the same time.

A four-row weeder-mulcher employing the principle of the spring-tooth harrow.

INTERNATIONAL HARVESTER COMPANY





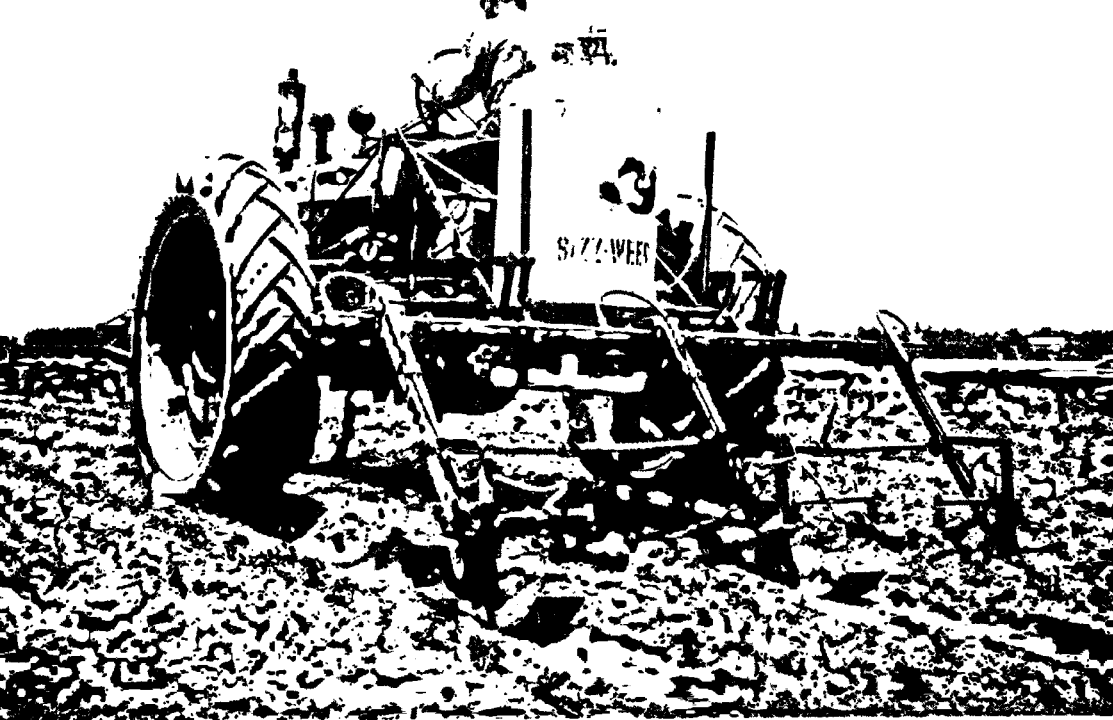
DEERE AND COMPANY

A four-row sweep cultivator for use on flat terrain.

A rotary hoe used for pulverizing the soil crust and destroying weeds.

DEERE AND COMPANY





INTERNATIONAL HARVESTER COMPANY

A flame weeder removing weeds in the rows of young cotton. Sweep blades for the middles are mounted at the front of the tractor.

Dusting cotton with insecticides or defoliants by airplane.

NATIONAL COTTON COUNCIL



several demonstration machines to Arizona and California, where he established a custom picking business. John Rust was left with the decision as to whether to go on.

He had reached the discouraging conclusion that his machine as it then existed lacked sufficient durability for general sale. Working models, while they would pick cotton when kept in continuous repair, tended to break down in the field when critical parts became worn. Rust thereupon set about redesigning the entire machine from the drafting board with the requirements of quantity production in view.

THE ADVENT OF THE COMMERCIAL PICKER

It was at about this time that the long efforts of the International Harvester Company to develop a commercially satisfactory picker came to fruition. Under the leadership of A. W. Scarratt and C. R. Hagen the company had in 1940 made a major change in the construction of its experimental harvester. The direction of travel of the tractor was reversed and the picking unit mounted on the rear of the tractor so that the cotton plants passed through the picking throat of the machine before the plants contacted any part of the tractor. This had several advantages. The problem of knocking cotton to the ground before it could be picked was eliminated. The operator was seated directly over the row for good driver vision, and the large capacity basket could be located out of the way behind the driver, where it was automatically loaded without requiring his attention. Thus one man could operate the entire mechanism with relative ease.

In order to handle the rank-growing cotton of the Delta and irrigated areas it was decided to increase the height of the picker drum box from fourteen to twenty spindles and to mount it on a higher clearance tractor. This machine performed so successfully in tests conducted in 1942 that Fowler McCormick, president of the International Harvester Company, announced in November of that year that the machine was ready to go into production.²⁵ He pointed out that as the cotton picker had never before been produced for commercial sale, the company had no allocation of materials to begin quantity production, but he suggested that if increasing farm manpower stringencies

25. "Cotton Harvester; International Harvester's Machine," *Newsweek*, XX, No. 23 (December 7, 1942), 68; "Six-bale Picker," *Business Week*, No. 743 (November 27, 1943), 69-70, 72.

required it, the company would undertake to produce a number of machines for use in critical areas.

The war and the adjustment period following precluded full-scale operations for a time, but International Harvester began making a few machines each year on a shop production basis. About twelve machines were made in 1941 and 1942, fifteen in 1943, twenty-five in 1944, and seventy-five during each of the next three years.²⁶

From 1942 to 1947 company engineers devoted their attention to cost reduction to facilitate the manufacturing process. The decision was made to bring out first a high-drum machine mounted on a heavy Model M tractor. Late season experience in the Mississippi Delta had shown that increased power was needed to operate in muddy fields, and the greater power of the Model M was also desirable for other farm operations in the areas where the picker was first to be introduced.

Some of these machines were put on trial on the Hopson brothers' plantation at Clarksdale, Mississippi, on whose land in 1944 was harvested what was believed to be the first commercial cotton crop ever produced entirely by machinery, with no purely hand labor used at any stage of the crop. Delinted seed was used and the cotton planted to a stand to reduce the necessity for chopping; the cotton was cultivated six times with flame weeders; and defoliation was accomplished by airplane dusting to aid the successful use of mechanical pickers. The Hopson Planting Company had for many years taken the lead in efforts to achieve total mechanization of the crop.²⁷

International Harvester's announcement that it was ready to enter commercial production, coupled with the increasing reports of farm labor shortages heard during the war and the prospect that total mechanization of cotton production would at last be technically feasible, stimulated a race on the part of other implement firms to get into the market with a similar picker. Most of this activity was veiled in an atmosphere of commercial secrecy, but at least two firms besides International Harvester were known to be redoubling their efforts. One of these was Deere and Company, which, as has been noted, was about to enter quantity production of an improved cotton stripper, and which from 1943 to 1946 sought to develop a spindle picker based on the design of Charles R. Berry. By 1949, however, the company, using

26. R. C. Archer, "Progress in the Mechanical Picking of Cotton," *Proceedings of the Second Annual Beltwide Cotton Mechanization Conference*, 7.

27. "Mechanical Crop," *Business Week*, No. 790 (October 21, 1944), 54, 57.

new designs, had produced only a small number of single-row pickers suitable for mounting on a conventional tractor, and a few two-row self-propelled units. The chief problem by this time was not simply to fashion a machine that would satisfactorily pick cotton, but because of its great complexity, to bring the costs of manufacture down sufficiently to insure quantity sales and thus to justify volume production.

The other principal contender seeking to produce a spindle picker was the Allis-Chalmers Manufacturing Company. In 1944 this company reached an agreement with John Rust to manufacture cotton picking machines utilizing his new designs, but modified his smooth wire spindle somewhat by adding a knurled surface. Owing to postwar difficulties in getting into production, the company had built only forty-nine machines by the end of 1949.²⁸

In the face of a still uncertain future regarding the adoption of mechanical cotton pickers, the International Harvester Company under the leadership of R. P. Messenger, executive vice president, proceeded with the construction of a new plant at Memphis. The plant was completed in 1948, and thereupon the company captured the lead in the production of spindle pickers with an announced output of over 1,100 machines in that year. The first commercial model was priced at \$5,985 at the factory, and when mounted on a Farmall M tractor the total cost came to \$7,600. Professor Fite commented, "This is an astronomical sum for over half of the cotton growers who produce less than four bales of cotton a year and farm less than 30 acres of cropland."²⁹

Nevertheless, a commercial market for the machines was developing among the larger operators and among those who planned to use them for custom picking. From this time on the production of spindle pickers began to assume quantity proportions. By the fall of 1952 the International Harvester Company announced that it had manufactured more than 8,000 machines. Included in this total were a number of low-drum units mounted on smaller tractors introduced in subsequent years. These machines had 420 rather than 600 spindles, weighed 2,000 pounds less than the big Model M high-drum picker, and sold for almost \$2,800 less. At this price it was estimated that mechanical harvesting could profitably be employed by farmers who produced as few as

28. C. E. Frudden, "Harvesting Research and Development," *Proceedings of the Third Annual Beltwide Cotton Mechanization Conference*, Bennettsville, South Carolina, August 17-19, 1949 (Memphis: National Cotton Council of America, 1949), 88.

29. Gilbert C. Fite, "Recent Progress," 27.

fifty bales a year. By 1956 the company was ready to introduce a series of two-row cotton pickers in both low- and high-drum versions.

In the intervening years the Allis-Chalmers Company had acquired a new plant at Gadsden, Alabama, and turned out an estimated 1,200 pickers between 1949 and 1952. These included a large two-row machine and a new small single-unit model that was priced at under \$2,500 (exclusive of the tractor) to bring it within the reach of a greatly increased number of users.

During the same period Deere and Company produced about 750 spindle pickers. The company's two-row model employs four picker drums to pick two rows simultaneously from both sides of each row. A new entrant to the field, Ben Pearson, Inc., built 1,500 one- and two-row machines from 1949 to 1952. This firm, located at Pine Bluff, Arkansas, had been devoted almost exclusively to the production of archery equipment prior to the war, but had been seeking another line of manufacture. It went into the production of cotton pickers in 1949 largely in response to local interest. The Pearson machines, like those of Allis-Chalmers, are based on Rust patents under a non-exclusive license. The two-row model embodies an early Rust idea for increased efficiency in picking extremely high-yielding cotton. The two picker units can be arranged in tandem so that each row is picked twice as the machine passes over it.

Recently the J. I. Case Company and Massey-Harris-Ferguson, Inc., have added Rust cotton pickers to their respective lines of farm machinery. These machines are manufactured under contract by Ben Pearson, Inc., and mounted on tractors of the two companies.

GROWTH IN THE MANUFACTURE OF MECHANICAL HARVESTERS

The growing acceptance by farm operators of the spindle picker as a successful farm tool rather than an experimental device is clearly indicated in Table 2. The figures on annual and cumulative output of cotton harvesters for domestic use from 1946 to 1953 are based on manufacturers' confidential reports to the National Cotton Council and the Bureau of the Census. They reveal during this eight-year span the transition from minor to significant commercial production of the machine. Sales to farmers tended to lag substantially behind production until 1948, but began to pick up rapidly in that year. Allowing

for obsolescence it is estimated that over 18,000 spindle pickers (as well as over 23,000 stripper harvesters) were available for use during the 1955 harvest. The distribution of these machines will be discussed in Chapter 8.

Table 2

PRODUCTION OF SPINDLE-TYPE COTTON PICKING MACHINES
IN THE UNITED STATES, 1946-1953

	Spindle-type pickers manufactured *	Cumulative total
1946 and prior years	107	107
1947	649	756
1948	766	1,522
1949	901	2,423
1950	1,527	3,950
1951	3,419	7,369
1952	4,590	11,959
1953	3,741	15,700
Estimated reduction by obsolescence through 1952		150
Number available for 1953 harvest		15,550

SOURCE: 1946-1950: Estimates prepared by National Cotton Council of America. 1951-1953: U.S. Bureau of the Census, *Farm Machines and Equipment. Facts for Industry*, Series M35A (Washington: Bureau of the Census, annual dates, 1951-1953).

* Beginning with 1951, figures represent only number of machines manufactured for domestic use.

At the present time a tremendous amount of developmental work is being applied to the improvement of mechanical harvesting methods. Most of the research is being directed toward two goals: (1) refinements in present devices that will permit cleaner and more thorough picking under all types of conditions; and (2) reduction in the size and cost of machines to permit their wider use throughout the cotton region.³⁰

30. Until his death in 1954 John Rust continued to make contributions toward both these goals. He designed a "whirling fluffer" device to make his machine pick more aggressively under adverse conditions, and he continued to refine the design of a pull-model picker for power take-off operation which he hoped would some day make the spindle picker available to small farmers who could not afford a tractor-mounted one.

A lively competition is also being carried on, both by commercial interests and by agricultural research agencies, to determine which type of machine is best adapted to particular local conditions within the region. Under the regional cotton mechanization research program in the Southeast, for example, the primary responsibility for research in the use of the spindle picker has been assigned to the South Carolina Agricultural Experiment Station, and in the use of the stripper to the Alabama Agricultural Experiment Station. Several other stations are cooperating in these trials.

Annual beltwide cotton mechanization conferences are held each year in various portions of the Cotton Belt under the sponsorship of the National Cotton Council of America. These meetings have brought together the representatives of a wide variety of interests in improved cotton production and were particularly important in the early years of the current technological revolution in exchanging pilot experience, devising ways to meet developing problems, and stimulating continued interest in the face of occasional set-backs. Each year the conference addresses itself to a particular set of problems, such as the development of mechanical methods applicable to small farms. It has performed an invaluable educational service in this way.

CHAPTER 7

Other Machines and Methods Aid the Process

AS HAS BEEN NOTED, it is doubtful whether the increasingly demonstrated practicability of mechanical harvesting would have excited the interest of farm operators in the Old Cotton Belt during recent years if it had not been for the prospect of mechanizing other stages of the production process and thus eliminating the need for a large resident labor force. Not only has substantial progress been made in reducing the principal secondary bottleneck—thinning and grass removal—to technological control, but a number of complementary developments have established the technical feasibility of total mechanization of the crop in important parts of the region. These developments are best described in their relation to the crop cycle.

Cultural practices vary considerably within the Cotton Belt, depending upon such factors as terrain, soil types, and the need for drainage or irrigation control. The following description of changes in practices will for the most part apply particularly to the Mississippi Delta, where some of the most intensive and sustained research has been going on in the development of complete mechanization systems suited to the humid areas. With minor modifications the methods being worked out here are probably applicable to many other areas in the South, especially on alluvial lands.

To a significant degree the advent of mechanical harvesting imposes rather stringent requirements on every stage of crop production from

seedbed preparation to the defoliation operation which immediately precedes the harvest. In the words of William E. Meek, senior agricultural engineer in charge of mechanization studies at the Delta Branch Station of the Mississippi Agricultural Experiment Station,

Mechanical farming is precision farming. To obtain precision, uniformity is essential. Crop rows must be uniformly spaced and of uniform height and shape. From seedbed preparation through planting and cultivating, uniformity must be paramount. It cannot be overemphasized. To attain uniformity, the proper implements must be used and used correctly. Good operation and close supervision are essentials for mechanized farming.

Timeliness is most important and can be had only by an adequate amount of field equipment. The equipment necessary to time the various operations most advantageously will represent a high investment per acre.¹

IMPROVEMENTS IN METHODS OF SEEDBED PREPARATION

Preparation for a mechanized harvest begins with the effective disposal of plant residue from the preceding crop. This may be done immediately after the harvest, or postponed until spring. Tractor-mounted stalk cutters and shredders are now available which cut, chop up, and scatter the fibrous stalks so that they will be turned under during succeeding operations and decompose quickly. The long-standing practice of burning cotton stalks in the fields is now widely recognized by farmers to be wasteful of organic matter. On the other hand, not to dispose of the stalks thoroughly is to invite trouble from the clogging of planters, cultivators, and especially the expensive mechanical harvesters. This primarily accounts for the development of mechanical stalk shredders, which are now available in three basic designs: those with horizontal, those with vertical, and those with radial cutters. A tractor-drawn rolling stalk cutter developed in 1925 is the one most commonly in use.

Seedbed preparation, which follows crop residue disposal, may be done by either of two methods: flatbreaking with a plow, or raising a bed in the row with a middlebreaker. The former method has the advantage that it leaves the ground relatively flat for effective flame

1. William E. Meek, "Mechanization of Cotton Production," *Agricultural Engineering*, 28, No. 12 (December, 1947), 543. Much of the following description is based on this excellent summary of the most advanced current cultural practices in the Delta.

weeding and cross cultivation, but drainage and irrigation requirements often demand bedded rows. Furthermore, the middlebreaker will cover more acreage in a day than the plow, and in a large operation this saving in time is important at a critical period of the year. Hence bedded rows are common in most areas.

The availability of more powerful tractors has permitted the development of three-row middlebreakers with the outer bottoms mounted in front of the rear wheels. The advantage of this arrangement over the older two-row breakers, on which one tractor wheel must run on the bed, is that, in addition to the saving in time, the rows are of uniform height and slope. This is essential to the effective operation of the flame weeder, and later it facilitates the operation of the harvester. On irregular terraced land it may be necessary to continue to use two-row equipment in order to get uniform spacing for all mechanical operations.

INNOVATIONS IN FERTILIZATION

Fertilizer may be applied by several alternative methods at the time of seedbed preparation or later. An important innovation in Delta agriculture which has resulted in substantial cost savings to farmers has been the recent widespread introduction of anhydrous ammonia as a nitrogenous fertilizer. Anhydrous ammonia is a synthetic hydrocarbon, one of the new petrochemicals. It takes the form of a gas at atmospheric pressure and normal temperatures, but becomes a liquid under pressure and is handled commercially in this form. It is a highly concentrated source of plant nitrogen and is easily and efficiently applied because of its property of fixing itself upon contact with the soil when released into the ground under pressure. The equipment used to apply the ammonia is fairly simple, consisting essentially of a pressure tank mounted onto a two- or a four-row tractor, from which distributing tubes lead to a set of hollow chisels used to seal the gas within the beds.

The new source of nitrogen became available to farmers in 1947 after four years of application research by the Mississippi Agricultural Experiment Station. In that year it was used on approximately 200,000 acres in Mississippi. Two years later an estimated one million acres in the state were receiving applications of anhydrous ammonia. The principal factor accounting for its rapid adoption was the reduction in fertilizer costs which it made possible. According to a study by James P. Gaines and Grady B. Crowe, a farm which fertilized as many as

four hundred acres of crops with anhydrous ammonia in 1949 saved two to three cents per pound of nitrogen in comparison with those using solid fertilizers. This was estimated to amount to a saving of more than one dollar per acre at the usual rate of application.²

Unfortunately the advantages of the new fertilizer are not nearly so great outside the Delta, where nitrogen is usually the only soil nutrient needed.³ Most soils in the hill areas are deficient in potash and phosphorous as well, and therefore require a complete fertilizer. Moreover, because farms in the Delta tend to be larger in size, they can better afford to store and handle anhydrous ammonia in the large pressure tanks in which it is most efficiently utilized.

However, considerable progress has also been made in recent years in the effective application of solid fertilizers. Research at various experiment stations has shown that germination can be improved, control of grass and weeds simplified, and yields increased by proper placement of fertilizer in relation to the seed.⁴ Most of the newer methods require the uniform placement of fertilizer at recommended depths, for which the light one-row walking type machines in common use are not well suited. With existing tractor attachments the problem is greatly simplified. Thus, even though tractor power is not essential for this farm operation, when the tractor becomes available on a farm this is one of the ways in which its usefulness is multiplied.

IMPROVEMENTS IN METHODS OF PLANTING

The principal recent improvements in planting methods have focused on aids to uniform germination and planting to a stand, with the object of facilitating mechanical thinning and cultivation. One method of planting is the hill-drop method, which results in a considerable saving in the amount of seed required and virtually eliminates the thinning

2. James P. Gaines and Grady P. Crowe, *An Economic Appraisal of Anhydrous Ammonia as a Nitrogenous Fertilizer* (Mississippi Agricultural Experiment Station, mimeographed, State College, April, 1950), 23.

3. In California irrigated cotton anhydrous ammonia is added directly to the irrigation water to provide a conveniently utilized source of nitrogen. "Ammonia as Fertilizer," *Fortune*, XXXVIII, No. 2 (August, 1948), 101, 103.

4. George R. Boyd, Charles A. Bennett, and William E. Meek, "Mechanization of Cotton," *Study of Agricultural and Economic Problems of the Cotton Belt*, Hearings before the Subcommittee on Cotton of the Committee on Agriculture, House of Representatives, 80th Congress, 1st Session, Part 2, October 10, 1947 (Washington: Government Printing Office, 1947), 994.

operation.⁵ The planter is equipped with a hill-drop attachment which deposits the desired number of seeds in hills at regularly spaced intervals. Where the terrain permits, accurate, high-speed checkrow planting can be achieved with two- and four-row planters. Mechanical and chemical processes have been developed for delinting planting seed so that it can be handled more effectively by these machines. When the checkrow method of planting is used the crop can subsequently be weeded efficiently by cross cultivation.

Another method of planting which is commonly used is to drill the cotton solidly in the row, after which it may be mechanically chopped to a stand or thinned by flame blocking. A variable-depth cotton planter has been developed which places the seed at several depths and thus increases the chances of securing a good stand under varying weather conditions. A uniformly germinated field of cotton may readily be thinned by cross-plowing with a tractor cultivator. However, this method can be safely applied to a relatively small percentage of farms in the Cotton Belt because it encourages excessive erosion damage on even slightly sloping land.

IMPROVEMENTS IN METHODS OF THINNING AND WEED CONTROL

The recent concentrated attack on the problem of eliminating hand labor from the hoeing operations of thinning and weeding the crop has brought forward a diversity of methods, no one of which is completely reliable, but various combinations of which have given promising results. Three approaches to this problem have emerged: mechanical, thermal, and chemical.

The attempt to design a mechanical cotton chopper and cultivator has a long history, but only recently have reasonably satisfactory chopping machines appeared which will remove unwanted plants at regular intervals and leave the remaining plants uninjured.⁶ These

5. H. F. Miller, Jr., "Planting Cotton to a Stand," *Agricultural Engineering*, 30, No. 10 (October, 1949), 487-88.

6. Mule-drawn forerunners of the modern rotary hoe are described in "A Combined Cotton Chopper and Cultivator," *Scientific American*, LXII, No. 7 (February 15, 1890), 100; and "A Cotton Chopper and Cultivator," *ibid.*, LXIV, No. 4 (January 24, 1891), 57. For a more recent development see "Further Steps Toward Mechanized Cotton Growing: Cotton Chopper and a Cotton Harvester," *Science News Letter*, 49, No. 20 (May 18, 1946), 313.

machines consist of a two-row tractor-drawn framework on which are mounted two sets of curved knives. The knives rotate vertically across the row taking out some plants and allowing the remaining ones to pass between the strokes.

The most common mechanical tool in use for cultivation is the sweep blade, long used as a mule-drawn implement. Since the advent of the rubber-tired tractor, the cultivating sweep has had to be radically redesigned to permit shallow cultivation at relatively high speeds. The improved "Texas type" sweep can be operated at tractor speeds of from $4\frac{1}{2}$ to $6\frac{1}{2}$ miles per hour without throwing an excessive amount of dirt on the young crop. It is often used in combination with a rotary-hoe attachment. The sweep cleans the weeds between the rows and the rotary hoe cultivates in and around the young cotton plants in the row while its revolving blades incidentally serve as shields against dirt flying from the sweeps. The saving in time resulting from this combined operation is indicated by the fact that eighty acres per day can be cultivated with the tractor-mounted rotary hoe and sweeps, as compared with three-fourths of an acre per day with a half-row cultivator and mule.⁷

Thermal, or flame, cultivation as a means of selective eradication of grass and weeds within the cotton crop made its appearance in the late 1930's and began to receive intensive testing in 1943.⁸ The equipment consists of a series of burners mounted on the rear of a two- or four-row tractor with the jets directed toward the area at the base of the cotton plant. Propane or butane gas is supplied to the burners from a tank carried on the tractor. Experiments have shown that flame can successfully be applied at the base of the cotton plant when the stem of the plant has reached a diameter of $\frac{3}{16}$ inch at the ground line. At this time the plants will be from 6 to 10 inches tall and will have developed a tough outer bark that can withstand the intense heat of

7. Charles R. Sayre, Jr., "The Economics of Mechanization in Cotton Production" (Ph.D. dissertation, Harvard University, 1948), 55.

8. Thomas L. Bagette, "Flame Cultivation and Other Mechanization of Cotton in the Yazoo-Mississippi Delta," *Agricultural Engineering*, 27, No. 9 (September, 1946), 411. See also J. Winston Neely and Sidney G. Brain, *Control of Weeds and Grasses in Cotton by Flaming* (Mississippi Agricultural Experiment Station, Circular 118, State College, March, 1944); Bagette, "Farm Engineering in Flame Cultivation," *Agricultural Engineering*, 28, No. 12 (December, 1947), 548-50; Carl B. Danielson and Grady B. Crowe, *Studies of Flame Cultivation in Cotton, Yazoo-Mississippi Delta, 1947* (Mississippi Agricultural Experiment Station, Circular 143, State College, October, 1948).

the flame treatment. Young weeds are killed by the heat, but to remain effective the treatment must be continued at intervals of from four to ten days until the crop is laid by. The flame weeder has also been adapted to thinning very young cotton by equipping it with a set of rotating shields, or buckets, which protect some of the plants but expose the rest to the destroying heat of the flame.⁹

Sweep cultivation of the middles is conducted simultaneously with flaming, and when double burners are used in the older cotton, tractor speeds of 4½ miles per hour can be resumed. This compares with speeds of under three miles per hour that are necessitated in flaming young cotton, when only one burner per row can safely be used. Because the flame is readily deflected by dirt heaped in the row, the introduction of flame cultivation requires that farmers give a great deal more attention to maintaining low, flat beds in their fields. Moreover, there is usually some need for hand labor for cultivation between planting time and the time the cotton is large enough to be flamed. Despite these limitations, in a study conducted in 1947 it was estimated that farms using flame cultivation and hand labor, compared with farms using hand labor alone, effected savings averaging three dollars per acre on weed-control operations.¹⁰

Chemical methods of weed control have been developed so recently that they have not yet undergone extensive testing in cotton production. However, the use of herbicides appeared to be so promising by 1951 that representatives of most of the major cotton-producing states participated in a conference on chemical weed control held in Memphis in December of that year under the sponsorship of the National Cotton Council. At this meeting the limited experience with chemical methods of weed control, including the results of two years of experimentation by several state experiment stations, were summarized and a description of the new techniques disseminated.¹¹

There are two types of chemical treatment, classified as pre-emergence and post-emergence, according to the chemical nature of

9. Thomas L. Bagette, "Thinning Cotton to a Stand with Flame," *Agricultural Engineering*, 30, No. 10 (October, 1949), 489, 495.

10. Grady B. Crowe, "Farm Mechanization Research in the South," *Agricultural Economics Research*, III, No. 1 (January, 1951), 4.

11. *Weed Control in Cotton with Herbicides: Progress Report for 1952* (Memphis: National Cotton Council, 1952). See also Grady B. Crowe, "Economics of Cotton Mechanization, with Particular Reference to the Yazoo-Mississippi Delta" (Ph.D. dissertation, University of Virginia, 1950), 73-98.

the materials used and the timing of their application. Most of the pre-emergence chemicals tested have been dinitro compounds applied as a spray in oil or water solutions, but other compounds, including one known as "chloro IPC," are also being evaluated. The solutions are usually applied to the seedbed surface in the same operation as planting. An auxiliary roller or modified press wheel is used to pack the seed firmly in the ground and smooth the crown of the seedbed, following which the herbicide is vertically sprayed directly onto the row. Pre-emergence treatments discourage the growth of small-seeded annual weeds such as crabgrass, brachiaria, and pigweed, but have little effect on established Johnson grass, nutgrass, Bermuda grass, and other perennials. Because the soil surface around the cotton plant must remain undisturbed while the treatment is in effect, the seed must be hill-dropped to a stand in order to eliminate thinning. Cultivation by mechanical means must be confined to the middles, and the sweeps set to avoid throwing untreated soil into the treated area.

A number of experimenting farmers in the Mid-South had unfavorable experience with pre-emergence treatments in 1952, when dinitro compounds apparently caused considerable injury to young cotton that came up during hot, dry weather in the latter part of April and early May.¹² The damage ranged from light injury in some cases to complete destruction of the cotton seedlings in others. This experience illustrated the need for further research before chemical applications could be safely recommended for large-scale use.

Post-emergence herbicides are petroleum derivatives consisting of special naphthas with a controlled content of petroleum aromatics. They are usually known collectively as herbicidal oils. Some of them are fortified with additional chemicals designed to increase their herbicidal effect. These compounds are harmful to most weeds and grasses when they come in contact with the leaves and growing tissues of the young plants. The stem of the young cotton plant happens to be protected from their deleterious effect by a waxy coating, although the buds and leaf surfaces may be damaged by the chemicals. It is therefore necessary that the post-emergence herbicides be applied in a flat horizontal spray from each side of the cotton row. The spray nozzles are set only

12. Comment by E. Buford Williamson in panel discussion on weed control, *Proceedings of the Sixth Annual Cotton Mechanization Conference*, Bakersfield, Shafter, Fresno, California, October 22-25, 1952 (reprinted from *The Cotton Gin and Oil Mill Press*, November 8, 1952), 20.

an inch from the ground and their adjustment, as well as the working pressure of the spraying system, must be kept under careful regulation.

Under favorable conditions three applications of post-emergence herbicides may be sufficient to control weeds in the drill row for the season. Further treatments are inadvisable, since the cotton plant loses its tolerance to chemicals as its stem coating develops cracks in the normal process of growth. If further weeding in the row is necessary, flame cultivation is recommended as the method least likely to dissipate the residual effects of earlier herbicidal dosages. Mechanical cultivation of the middles accompanies post-emergence spraying and, as in the case of pre-emergence treatments, must be performed with a minimum of soil disturbance.

In common all of these operations call for a precision of control that has rarely been required in farm operations. While this factor alone would not rule out their use, it imposes new standards of technical and managerial skill, as well as a diversity of equipment, likely to be available only on the larger farms. Since no single method of grass and weed control has proved dependable so far, it is probable that varying seasonal conditions will call for complex decisions as to which of a variety of possible combinations of methods to use. Nevertheless, the economic inducement to find a satisfactory solution is high. A recent study points out that of the thirty-nine hours of man labor which were required to produce and harvest an acre of cotton under advanced technological conditions at the Delta Branch Experimental Station in 1947, thirty-two man hours were used in chopping and hoeing for grass and weed control.¹³ This suggests the degree of importance which is currently being attached to a technological mastery of this set of problems. Herbicides in some form were used on about 5,000 acres of cotton in 1947, and on about 300,000 acres by 1952.¹⁴

IMPROVEMENTS IN METHODS OF INSECT CONTROL

The most significant advances in recent years in the field of cotton insect control concern the introduction of the new synthetic organic insecticides developed during the war years, such as DDT, benzene

13. Danielson and Crowe, *Studies of Flame Cultivation in Cotton*, 3.

14. *Thirteen Years of Progress in Cotton Production and Marketing* (Memphis: National Cotton Council of America, March, 1953), 8-9.

hexachloride, chlorinated camphene, and chlordane.¹⁵ In nearly all cases the use of these insecticides represents a substitution for older poisons that had not been entirely satisfactory. The practical effect of these substitutions, where they are successful, is to increase yields without making an appreciable difference in input costs or methods of application.

In view of the delicate biological balance which exists at any given time between the injurious and the beneficial insects present in the cotton field, the introduction of new insecticides without considerable advance exploration is fraught with certain hazards. For example, the successful control of one pernicious insect may simultaneously destroy the parasites and predators of another, and thus expose the crop to a new and unfamiliar danger. Something of this sort happened when calcium arsenate dust was discovered during the period of acute boll weevil infestation in 1916 to be the most successful weapon against this insect and thereafter came into extensive use. While it greatly reduced the boll weevil menace, the use of calcium arsenate also had the unfortunate effect of destroying the enemies of the cotton aphid, which thereupon multiplied rapidly, reducing both the yield and grade of infested cotton. In addition, the increase in aphids led to an increase in bollworm damage because the bollworm moths were attracted to the honeydew characteristically secreted on the cotton plant by the aphids.

Arsenical poisons have since been supplemented with nicotine and rotenone for aphid control, but the latter are expensive and often not readily available. Hence there was great interest in the new organic insecticides when they became known. DDT was first tested against cotton insects in 1943, but the early trials were disappointing, as the compound was found not to be effective against the boll weevil and the cotton leafworm. Moreover, like the arsenicals, it encouraged the increase of cotton aphid and red spider mite infestations by killing their natural enemies. Yet it proved to be more effective than any previously tested insecticide for the control of the bollworm, pink bollworm, cotton fleahopper, and a number of minor insect pests.

By 1945 other organic insecticides became available for testing, and

15. U.S. Bureau of Entomology and Plant Quarantine, "Recent Developments in the Control of Cotton Insects," *Study of Agricultural and Economic Problems of the Cotton Belt*, Part 2, 1021-42.

it was found that benzene hexachloride appeared to supplement DDT in a gratifying way by its effectiveness against the boll weevil, cotton aphid, and cotton leafworm, the three most important insects not subject to control by DDT. Since this time much insecticide research has centered upon the use of a mixture of these two compounds, as well as upon the testing of other related insecticides in the organic group.

Because many of the newer poisons are best applied as liquid sprays rather than as dusts, there will probably have to be an appreciable conversion of equipment to permit their effective use. Dusting as a means of applying insecticides grew popular in the Cotton Belt when it became known that lead and calcium arsenate were more lethal against the boll weevil as dusts than as liquid spray solutions. Furthermore, water was not always available in the cotton fields for spray mixtures, and the fact that liquid sprays were heavier than dusts made their handling more difficult.

Cotton growers have used many types of dusting machines, including hand guns and saddle guns operated by turning a hand crank, traction machines pulled by mules, power dusters operated by small mounted gasoline engines or by tractor power, and specially equipped airplanes. Airplanes came into use in 1921 to meet the problem of poisoning large acreages in a minimum time in order to arrest the boll weevil. They could also reach wet fields where ground machines would bog down. Within a short time several commercial airplane dusting companies were organized, and there are now over one hundred of these firms engaged in the application of insecticidal dusts and sprays from the air on a custom basis. Most of them operate in the cotton-growing states of California, Arizona, Texas, Arkansas, Louisiana, Mississippi, Florida, and South Carolina, where large unbroken acreages of cotton are sufficiently common to render this method of operation feasible.

Experiments are now under way in methods of improving the application of insecticides in the form of liquid sprays and as aerosols. These include the use of the helicopter, which may have some advantages over the use of the airplane for this purpose. Ground spray machines which can be operated from a tractor simultaneously with mechanical and flame cultivation of the crop have also been developed. Others are equipped with mounted motors and can be operated from motortrucks or animal-drawn vehicles. With some of the new types

of sprayers an acre can be covered with less than three gallons of concentrated spray solution.¹⁶ This is a particularly valuable feature in dry portions of the cotton region where water is difficult to obtain.

INNOVATIONS IN DEFOLIATION TECHNIQUES

The advent of mechanical harvesting has led to intensive research during the past decade in chemical methods of removing the leaves from the cotton plant. When stripping became common in the High Plains of Texas during the war, it was found necessary to postpone the harvest until frost had stripped the leaves from the plants in order to avoid clogging the strippers and adding an undue amount of leaf trash to the lint. The delay meant field losses from excessive exposure of the open bolls to the weather. In the Delta where the spindle picker was being introduced, rank cotton also clogged the machines and the staining of the lint from contact with bruised green leaves severely lowered its grade. The search began for a method that would hasten the normal defoliation of the plant.

The most commonly used defoliant has been a chemical dust in which calcium cyanamide is the active agent.¹⁷ The dust is applied in the same manner as an insecticide when the bolls are at least thirty days old and when there is little danger that yields will be reduced by a premature loss of the vegetative foliage of the plant. Calcium cyanamide can be used only where dew remains on the plant for at least three or four hours to permit the necessary slow hydrolysis of the chemical on the leaf. This stimulates the formation of an abscission layer of cells across the base of the leaf stalk, and the leaves then wither and fall. Calcium cyanamide has been readily available in the cotton region, where it had previously been in use as a fertilizer. Since 1949 it has been marketed in a concentrated, finely powdered form for more effective use as a defoliant dust.

Since calcium cyanamide requires a long dew period to be effective,

16. Albert P. Brodell and Charles E. Burkhead, *Spraying and Dusting Major Field Crops* (Washington: Bureau of Agricultural Economics, FM 88, mimeographed, July, 1951), 1.

17. Harris P. Smith, "Late Developments in Mechanical Cotton Harvesting," *Agricultural Engineering*, 27, No. 7 (July, 1946), 321-22; W. Hardy Thorp, "The Needs and Accomplishments of Defoliation Research," *Proceedings of the Third Annual Beltwide Cotton Mechanization Conference*, Bennettsville, South Carolina, August 17-19, 1949 (Memphis: National Cotton Council of America, 1949), 114-17.

it has not been suitable for use in the dryer portions of the Cotton Belt. In the western states promising experiments have been conducted with monosodium cyanamide, which is applied as a dust in the dry part of the day and then goes into solution on the leaf by absorbing moisture from the air when the humidity rises at night. Several defoliant sprays, including ammonium thiocyanate, potassium cyanate, endothal, and pentochlorophenol, which are less dependent upon dew and high humidity, are now available. However, the selection of the correct defoliant in a given crop season is subject to considerable uncertainty as the effectiveness of the defoliant is influenced by a complex growth history of the plant, weather conditions, and the dosage applied.

Several advantages of defoliation in addition to the facilitation of mechanical harvesting and grade improvement have been noted since the practice has increased. Cotton which has been defoliated opens faster in the boll and is less subject to boll rot on the lower branches, as a result of increased exposure to the sun and the drying action of air movement. Hence even farmers who intend to have their cotton picked by hand may wish to defoliate. Pickers can work faster and more comfortably, since the cotton is fully exposed and there are no leaves to provide cover for mosquitoes and other annoying insects. Defoliation also reduces insect damage. Boll weevils tend to disappear from defoliated fields, and aphids and leafworms lose their means of subsistence.

Despite the uncertainties connected with their use, defoliants have had increasing application on the larger cotton farms. In 1946 there was almost no chemical defoliation except on an experimental basis. The following year about five thousand acres of cotton were defoliated experimentally. By 1952 it is estimated that three million acres, or 11 per cent of the total American cotton acreage, were treated with defoliants.¹⁸

IMPROVEMENTS IN PROCESSING

SEED COTTON

The resort to mechanical methods of harvesting places a heavy burden on the final preparation of the crop for market, since machine harvested cotton often grades down as much as a full grade below the

18. *Thirteen Years of Progress in Cotton Production and Marketing*, 8.

same variety picked by hand. In the case of cotton gathered by spindle picker, which generally involves the use of a moistening agent to aid in doffing, the cotton is likely to be too wet to gin effectively. The grower has a direct interest in increasing the ginned quality of his product, since it is only following this stage that he offers it for sale.

In the process of developing the mechanical cotton harvesters now in use considerable attention was for a time devoted to supplementary methods of improving the condition of machine-picked cotton before it reached the gin. Undoubtedly there was some fear that roughly prepared cotton might not be accepted by ginner, and that this would adversely affect the future of the harvesting machines themselves. The difficulties in ginning sledged cotton (as well as hand-snapped cotton) in the High Plains of Texas have already been recounted. As early as 1935 the Texas Agricultural Experiment Station tried to solve the problem of excessive trash in the cotton stripped with its machine by designing a burr extractor and cleaner to be mounted on the tractor behind the stripper, where it formed part of the conveyor system to deliver the cotton to a trail wagon. This device was greatly improved in 1939 and, with modifications, it continues to be used on some of the commercial machines patterned after the Texas Station model.

In a similar effort to render the output of the spindle picker more acceptable to the gins, John Rust in 1940 announced that he had patented a tractor-mounted cotton cleaner which was designed to blow much of the trash out of the harvested cotton.¹⁹ The cleaner could be used as a portable machine in the field, or operated as an adjunct to the plantation gin.

It was soon recognized, however, that relatively little could be done to improve the quality of machine harvested cotton before it reached the gin, and that improvements in ginning methods were a more practical way of relieving the difficulty. In the course of developing its spindle picker the International Harvester Company in 1937 went so far as to erect an experimental drier and cleaner alongside the cotton gin on the Hopson brothers' plantation which was serving as its proving ground.²⁰ Later the company built an experimental gin on the Ohlendorff Plantation near Osceola, Arkansas. The information thus

19. "Cotton Cleaner," *Business Week*, No. 591 (December 28, 1940), 38.

20. C. R. Hagen, "Twenty-five Years of Cotton Picker Development," *Agricultural Engineering*, 32, No. 11 (November, 1951), 599.

derived was made available to ginnermen handling machine harvested cotton.

During this period the Stoneville Cotton Ginning Laboratory, which had been established in 1930 by the U.S. Department of Agriculture and the Mississippi State Experiment Station, had been engaged in an extensive program of investigating improved methods of preparing cotton for market. As the introduction of the mechanical picker became imminent this organization began to devise a succession of new ways of drying, extracting, ginning, and cleaning cotton to meet the new demands on the gins. Twenty of these improvements were granted public patents, and a number of minor devices were also made available to the ginnermen. So significant was this work that by 1947 it was possible to claim "there has been more improvement in ginning machinery in the past sixteen years than there had been from the time of Eli Whitney to 1930."²¹

As a result of the increasing importance of cotton growing in the western irrigated areas, where mechanization was making its greatest strides, a branch of the Stoneville Cotton Ginning Laboratory was established in 1949 at State College, New Mexico, to conduct research in the special ginning requirements of cotton grown under irrigation.

The modern, fully equipped gin now has, in addition to the conventional gin stands, an elaborate pre-ginning installation consisting of two or three cotton driers, one or two overhead burr machines or hull extracting units, twelve to thirty-five cylinder cleaners for the seed cotton, and a set of extractor feeders.²² At this point the cotton reaches the saw gins, which are now operated at much higher speeds than formerly, thereby increasing both the gin capacity and the quality of the cotton lint. An additional set of post-ginning lint cleaners, employing either the saw principle or an air jet, is available to remove fine particles from the ginned lint before baling, and some gins have installed this equipment.

Cotton driers were developed during the thirties and therefore have

21. Boyd, Bennett, and Meek, "Mechanization of Cotton," 1004.

22. S. Kelly Dimon, "Ginning Machine Harvested Cotton," *Proceedings of the Third Annual Beltwide Cotton Mechanization Conference*, 94-97; F. L. Gerdes, "Mechanization and Associated Technologies—Economics and Technologies of Modern Ginning," *Proceedings of the Fourth Annual Beltwide Cotton Mechanization Conference*, Greenville and Stoneville, Mississippi, July 13-15, 1950 (Memphis: National Cotton Council of America, 1950), 25, 32-33.

had an extended period of trial. By 1946 about 44 per cent of the active gins in the United States had installed such units, and these gins were estimated to have handled two-thirds of the crop in that year.²³ Lint cleaners have been a more recent development, and only about 5 per cent of the gins were equipped with them by 1950. However, these included 22 per cent of the gins in the western states, as contrasted with 4 per cent so equipped in Oklahoma and Texas, 7 per cent in the Mississippi Valley states, and 2 per cent in the southeastern states.

The effect of the newer methods of ginning on the quality of the product, and therefore on the price it will command, is appreciable. Studies conducted during the 1946 and 1947 crop seasons in Mississippi disclosed that specially equipped gins (but without the inclusion of a lint cleaner) turned out machine-picked lint cotton that averaged one-third of a grade higher in quality than that of similar cotton processed by standard gins.²⁴ The value of this grade difference was about eight dollars per bale on the basis of 1947 prices. Field tests of the newly developed lint cleaner in the Rio Grande Valley in 1948 and in the Yazoo-Mississippi Delta in 1949 indicated that a further improvement of one-half to two-thirds of a grade could be achieved when this device was incorporated in the gins, and that this would result in no adverse effect on the fiber properties of the cotton.²⁵

The elaborate facilities which are now required for the effective ginning of mechanically harvested cotton have profoundly affected the nature of the ginning enterprise. The equipment used in a modern gin requires about twice the building space and about twice the power supply which was needed for a standard ginning outfit only a few years ago. These factors, together with the rise in prices of ginning

23. Boyd, Bennett, and Meek, "Mechanization of Cotton," 1004. In the High Plains of Texas by 1947 approximately 85 per cent of the gins had driers, 88 per cent had overhead burr extractors, 100 per cent had overhead cylinder cleaners, and 98 per cent had extractor feeders. Zolon M. Looney, Robert A. Montgomery, and William E. Franklin, Jr., *Evaluation of Cotton Ginning Costs and Quality, High Plains Area of Texas, 1946 through 1948* (Washington: U.S. Department of Agriculture, processed, July, 1950), 3.

24. Grady B. Crowe, *Mechanical Cotton Picker Operation in the Yazoo-Mississippi Delta* (Mississippi Agricultural Experiment Station, Bulletin 465, State College, July, 1949), 15.

25. Vernon P. Moore, "Outline of Current Technological and Economic Research and Related Activities of the Stoneville Laboratory," paper presented before the Annual Meeting of the Tennessee Ginners' Association, Jackson, Tennessee, April 14, 1950 (Washington: U.S. Department of Agriculture, processed), 5.

machinery since 1945, have tripled the investment needed to build a gin which will satisfactorily handle machine harvested cotton. In addition, far from being able to operate a gin with a crew of relatively unskilled seasonal labor as in the past, the ginner today performs a complex technical function that requires a trained staff and close supervision. The farm gin that was operated as a subsidiary enterprise on the large plantation is rapidly giving way to a separate commercial enterprise reflecting a substantial investment. Better roads and the increasing availability of truck transportation have contributed to this trend by enlarging the service areas of the custom gins. In consequence of these changes, there has been a marked consolidation of ginning facilities. While in 1900 there were about 30,000 ginning plants in this country, by 1949 there were only about 8,000, and most of these necessarily embraced greatly enlarged capacities in order to accommodate the cotton crops of recent years.²⁶

As an enterprise the ginning business is afflicted with extreme seasonality of demand. Ordinarily the gins are in use for only about four months of the year, and the remainder of the time they stand idle incurring overhead charges in proportion to the investment. In short crop years some gins may not open at all. Some progress has been made in developing off-season community services which will utilize certain elements of the plant, such as power units, buildings, heaters, hydraulic pressure systems, and fans. Yet there is some danger that the increased adoption of mechanical harvesting will intensify the seasonal strain on the gins. According to one recent report,

This results from the speed of harvesting possible with spindle-type pickers. It has been demonstrated that the picking rate, especially when the pickers are operated two or more shifts per day, is in excess of the daily capacity of local gins. As the number of spindle pickers increase in any locality, it appears that all of the cotton could be harvested in a period of two months, whereas gin capacities are geared to a 4-month season. This means that provision must be made for the storage of surplus pickings to be ginned later as opportunity offers.²⁷

The recommendation is made in this report that research be undertaken to develop efficient and economical drying and storage equipment which could be located on the individual farm, rather than at the

26. Gerdes, "Mechanization and Associated Technologies," 32.

27. Boyd, Bennett, and Meek, "Mechanization of Cotton," 1007.

gin, where space is at a premium. The high moisture content of spindle-picked cotton renders such equipment particularly desirable, since both the commercial value and the viability of the seed in unginned cotton deteriorate rapidly when it is stored without predrying.

Problems associated with the straining of gin capacity due to rapid mechanization of the harvest have already been demonstrated in the High Plains, where some of the best equipped gins in the country are located. During the record crop season of 1949 many gins were operated continuously on a twenty-four-hour schedule for as many as sixty days without being able to meet the demands on them. Farmers were obliged to have their cotton stand in trailers on the gin yard from forty-eight to seventy-two hours while they waited their turn, or to pile their cotton in the fields or turnrows until it could be handled by the gins. Fortunately dry weather helped to minimize losses. A number of growers improvised pneumatic loaders or utilized tractor-powered hay stackers to facilitate the reloading of the enormous quantities of cotton which had to be dumped in the open during the height of the season.

Other recent developments in the preparation of cotton for market which are of minor, though not of negligible, significance are improvements in the methods of baling and of securing a reliably representative sample of the cotton in the bale for grading purposes. A number of local gins have found it mechanically and economically feasible to convert their low density baling presses to machines which will turn out bales of standard density. This eliminates the necessity for sending the cotton to a centrally located compress for rebaling before shipment to domestic mills. Because of the smaller size of bales, it also results in savings in freight and storage charges. An automatic sampling apparatus which will produce a sample representing a cross section of the contents of a cotton bale while the bale is being ginned has been developed at the Stoneville Cotton Laboratory and should in time replace the wasteful and somewhat unreliable method of hooking cotton from the bale to obtain samples which has prevailed until now.²⁸

28. George E. Gaus and John E. Larrison, *Automatic Mechanical Equipment for Sampling Cotton Bales during Ginning* (Washington: U.S. Department of Agriculture, processed, March, 1951).

ASSOCIATED DEVELOPMENTS IN
BREEDING AND SPINNING

Among those drawn into the collective effort to make the mechanization of cotton production an assured success are the breeders and the spinners. For each the growing trend towards a mechanized crop poses distinctive problems.

Cotton breeders have until recently directed their attention toward developing varieties and strains of cotton with some forty desired characters, the most important among which were high yields, increased fiber length, disease resistance, and desirable spinning qualities. Now, in addition, they are asked to develop cotton plants that are easily harvested by machine, easily penetrated by insecticides when thickly sown, and easily defoliated. In most cases genetic linkages cause a variety which is acceptable for some of these purposes to be rejected for others, and although these linkages can sometimes be broken, the breeding trials are relatively slow and require an enormous accumulation of records for analysis. Notwithstanding these difficulties some notable progress has already been made.

The most striking variety improvement related to the needs of mechanization is the development of stormproof cotton at the Lubbock Substation in the High Plains. The first attempts to breed by hybridization a variety having characteristics suited to mechanical harvesting were made in 1927.²⁹ The problem was to secure a high-yielding variety that would mature early, hold its lint in close, compact bolls, and grow erectly with few vegetative branches. Early maturity and compactness of boll were desired to eliminate waste from weather exposure and loss of cotton fallen to the ground; erect, leafless plants would facilitate mechanical stripping. The first crosses were made from a mutant strain of Durango cotton which had some of the desired properties, but lacked stormproofness. In 1930 M. A. Macha, a farmer near Tahoka, Texas, found a strain of stormproof cotton growing in a field of Half-and-Half from which he made selections for several years.³⁰ In 1936, D. L. Jones, superintendent of the Lubbock

29. H. P. Smith and others, *The Mechanical Harvesting of Cotton* (Texas Agricultural Experiment Station, Bulletin 452, College Station, August, 1932), 55.

30. H. P. Smith and others, *Mechanical Harvesting of Cotton as Affected by Varietal Characteristics and Other Factors* (Texas Agricultural Experiment Station, Bulletin 580, College Station, December, 1939), 5.

station, obtained specimens of this cotton, which he named the Macha variety. Crossing of Macha and other varieties continued until several excellent stormproof varieties were obtained which could be recommended for planting in the High Plains and the adjacent Rolling Plains. By 1952 High Plains farmers indicated their intention to plant about 90 per cent of their cotton acreage to stormproof types.³¹ This area produces about 25 per cent of the annual Texas crop, and 10 per cent of the entire American crop. In the Rolling Plains, which produce an additional 7 per cent of the country's supply of cotton, there has also been a considerable shift to stormproof types.

Another example of a remarkably rapid mass shift from one type of cotton to another, although not primarily related to mechanization, was the adoption of Acala 4-42 cotton by the farmers of California in 1949.³² This was a cotton adopted primarily for its higher yield and finer quality than the strain of the same variety which it replaced, but it also has important characteristics of storm resistance, larger bolls, and decreased susceptibility to disease. A unique state law passed in California in 1925 requires that all commercial cotton planted be of one variety, and this is the second time that such a statewide shift has been made.

George J. Harrison, principal agronomist at the U.S. Cotton Field Station at Shafter, California, has been responsible for developing both the improved Acala 4-42 and its predecessor Acala P-18, which was adopted in 1941 as an outcome of breeding trials begun in 1934. He is currently engaged in the examination of strains which may be better suited to harvesting with the spindle picker and generally adapted to the special demands of completely mechanized production. The most promising lines of breeding research appear to be efforts to reduce the foliage hair coating which becomes tangled with the lint in picking; the selection of open-growing, erect plants which will permit the penetration of sunlight, insecticides, and defoliant into dense plantings; and the selection of boll conformations which will lend themselves to spindle picking.³³ On the other hand, some desirable characteristics

31. D. L. Jones and Levon L. Ray, "Stormproof Cotton Cuts Harvest Costs," *What's New in Crops and Soils*, 4, No. 9 (August-September, 1952), 12.

32. Richard Donovan and Dwight Whitney, "Away Out West in the Land of Cotton," *Collier's*, 127, No. 25 (June 23, 1951), 48, 50; "California's Cotton Rush," *Fortune*, XXXIX (May, 1949), 88, 135-36.

33. George J. Harrison, "Breeding and Adapting Cotton to Mechanization," *Agricultural Engineering* 32, No. 9 (September, 1951), 486-88, 492.

such as uniform defoliability and the absence of fruiting branches which are too low to be reached by the picker do not seem to be as amenable to genetic control as to control by recommended cultural practices.

In other parts of the Cotton Belt similar breeding experiments are being conducted by both governmental and commercial breeders, who are in general trying to modify varieties which are already adapted to local conditions in ways which will make them more suitable for mechanical harvesting while retaining the other characteristics which have led to their earlier adoption. Many of the widely grown older varieties, such as Deltapine, Stoneville, Delfos, and Coker, are believed to be adequate for mechanical handling provided that careful cultural practices are followed. An important function of the breeder in the mechanization process is to establish which aspects of the growing plant are likely to yield to genetic modification, and which can be more fruitfully approached through cultural changes and the adaptation of machines. This is particularly significant since a period from seven to ten years is usually required from the origination of a new strain until it has been tested sufficiently to warrant adoption.

For the cotton spinner mechanically harvested cotton presents certain problems which are difficult to overcome. No matter how adequate the ginning process the lint is usually reduced in grade by the presence of finely divided pepper or pin trash and, in the case of cotton from the rain belt, by chlorophyll staining. Some of these deficiencies can be reduced by further cleaning at the mills, but the results are almost certain to be a neppy, tangled lint and a weakened fiber. Moreover, the extra handling increases the mill costs. Mechanically harvested cotton from grass infested fields is particularly difficult to spin properly, and therefore is likely to be unacceptable to many mills. So far the problem has not assumed large proportions because of the limited quantities of machine picked cotton arriving at the mills, but there is no doubt that it is going to grow.³⁴

Efforts to deal with the deterioration of grade will probably have to be made primarily on the farm and at the gin through such meas-

34. M. Earl Heard, "A Spinner's View of Mechanical Harvesting," *Proceedings of the Third Annual Beltwide Cotton Mechanization Conference*, 158-62; Leonard J. Watson, "The Effect of Mechanical Harvesting on Quality," *Proceedings of the Fifth Annual Cotton Mechanization Conference*, Chickasha, Oklahoma, November 8-9, 1951 (reprinted from *The Cotton Gin and Oil Mill Press*, November 24, 1951), 25-26.

ures as more effective weed control, more adequate defoliation, and more careful processing of the picked cotton. There is evidence that in some respects mechanical picking may even improve the quality of the product by extracting only the longer staple fibers and by contributing to the timeliness of harvesting. Apparently the fiber strength is not lowered by the harvesting method.

Spinners are inclined to point out, however, that it is not sufficient for farmers to accept a lower price based on a lower grade product, and to make up the difference on their greatly reduced costs, if they expect cotton to maintain a competitive position with the synthetic fibers. From the viewpoint of spinning quality synthetic fibers are clean and tend to have a more uniform affinity for dye than neppy cotton. And it is in the finer grades of textiles that cotton has had some of its most acute competition from synthetics in the consumer goods market.

Some analysts see in this quality relationship an opportunity for small cotton growers who do not have the resources to mechanize their production to stay in competition with the large mechanized enterprises, since they will in effect be producing a specialty product, hand-picked cotton, which should command premium prices. It is difficult to see, however, because of the high labor input which will be necessary, how such farming could be carried on except at the low standards of living which already prevail in much of the South. A few large growers have expressed the intention, at least for the near future, to continue to pick their crop the first time over by hand, in order to command a premium for this cotton. They plan to use mechanical harvesters to "scrap out" the crop, in the belief that the late cotton is already so subject to weather damage as to suffer little additional damage in grade from machine harvesting. This type of operation presupposes the continued availability of seasonal hired labor for hand picking, even though the other stages of the crop are completely mechanized, and this assumption is no doubt justified in some portions of the Cotton Belt.

CHAPTER 8

The Regional Pattern of Mechanization

TO WHAT DEGREE have cotton farmers actually adopted the new machines and methods which have become available during the past eventful decade? Mechanization has entered the Cotton Belt in a very uneven way, and there are areas in which the transition is difficult to achieve at all. As has already been suggested, many factors influence the process, among them the availability of machines, the relative abundance of labor, differences in terrain and condition of the soil, access to credit, and force of custom. To a considerable degree, of course, the net effect of this tangle of influences can be reduced to comparisons of cost savings of various methods, although non-economic considerations also play a part in the adoption of new methods.

This chapter will describe, insofar as the data are now available, the degree of mechanization which has been achieved in various parts of the region. This will be followed by an evaluation of the labor-saving and cost-saving effects of the new techniques as a key to their rates of introduction.

PARTIAL VS. COMPLETE MECHANIZATION

The rate of introduction of the tractor is commonly taken as the most significant index of the degree of farm mechanization in a particular area. While it is a very useful indicator for this purpose, it is nec-

essary in interpreting the data on tractors to bear in mind the important distinction between the stages of partial and of complete, or nearly complete, mechanization. In the case of the former, tractor power may be used for only a limited number of operations, and in cotton production in particular these are not likely to be the most labor-consuming tasks. The presence of a tractor on the farm therefore may represent a degree of mechanization far short of complete. However, the tractor may greatly facilitate the conduct of supplementary enterprises, such as grain or soybean farming, and in these parts of the farm operation total mechanization may occur well in advance of a similar stage in the cotton crop. Furthermore, the availability of tractor power on the farm may lead to important changes in tenure arrangements, as will be explained in Chapter 11, and thus it paves the way for a rapid transition to full mechanization when that becomes feasible.

THE PATTERN OF INTRODUCTION OF THE TRACTOR

Table 3 shows that in the ten states where cotton is an important crop, there has been a rapid acceleration in the acquisition of tractors during the war and postwar years, in contrast with earlier years, when particularly the southeastern states lagged far behind the nonsouthern states in rates of tractor introduction. From 1920 to 1930 the number of tractors in the cotton states as a group increased at about the same rate as the national average, but the Great Plains states had earlier taken the lead and continued to maintain it. As a result, the proportion of tractors in use in the ten cotton states remained fairly constant at about 12 per cent of the national total, and even so, much of the responsibility for maintaining this ratio must be attributed to the grain areas of North Carolina, western Oklahoma, and the Texas Panhandle. During the following decade, however, the proportion in the cotton states increased to 14 per cent, and during the next five years to 17 per cent. By 1950, 21 per cent of the tractors in the United States were to be found in the ten cotton states.

The acceleration in tractor acquisition began in the western cotton states and moved eastward (although there were of course variations in the rate by local areas). During the thirties most of the increase in tractor numbers took place in Texas and Oklahoma. In Texas alone the rate of increase for the decade was 165 per cent, while the national rate had fallen to 70 per cent, and by 1940 Texas had 44 per cent of

Table 3

NUMBER AND PERCENTAGE CHANGE OF FARM TRACTORS,
UNITED STATES AND TEN COTTON STATES, 1920-1950

	Number of tractors on farms *					
	1920 Jan. 1	1925 Jan. 1	1930 Apr. 1	1940 Apr. 1	1945 Jan. 1	1950 Apr. 1
United States	246.0	505.9	920.0	1,567.4	2,421.5	3,609.3
Nonsouth	209.6	426.1	774.2	1,295.9	1,923.4	2,687.0
North Carolina	2.3	7.9	11.4	12.8	31.2	73.5
South Carolina	1.3	2.9	3.5	4.8	12.4	30.3
Georgia	2.3	4.1	5.9	9.3	24.6	60.3
Tennessee	1.9	4.8	6.9	11.8	24.1	59.8
Alabama	.8	2.5	4.7	7.6	17.1	45.8
Mississippi	.7	1.9	5.5	10.6	21.1	51.7
Arkansas	1.8	3.5	5.7	12.6	26.5	60.3
Louisiana	2.8	3.5	5.0	9.5	17.6	35.7
Oklahoma	6.2	11.0	26.0	45.4	70.4	93.7
Texas	9.0	16.8	37.3	98.9	162.4	232.3
Ten Cotton States	29.1	58.8	111.9	223.3	407.4	743.4
Percentage in Cotton States	11.8	11.6	12.2	14.2	16.8	20.6
	Percentage of increase over previous date					
	1920- 1925	1925- 1930	1930- 1940	1940- 1945	1945- 1950	
United States	106	82	70	55	49	
Nonsouth	103	82	67	48	40	
North Carolina	247	45	12	145	136	
South Carolina	123	19	38	160	144	
Georgia	84	42	59	164	145	
Tennessee	155	44	72	104	148	
Alabama	204	89	64	123	168	
Mississippi	181	196	91	99	145	
Arkansas	91	64	121	111	128	
Louisiana	24	44	89	86	103	
Oklahoma	76	137	75	55	33	
Texas	86	123	165	64	43	
Ten Cotton States	102	90	100	82	83	

SOURCE: U.S. Bureau of the Census, *U.S. Census of Agriculture: 1950*. Vol. II, *General Report*, Statistics by Subjects (Washington: Government Printing Office, 1952), Table 15.

* In thousands. No census of tractor numbers was taken in 1935.

the tractors in the region. No tractor count was taken in the agricultural census of 1935, but it is believed that the greater part of the increase came in the latter part of the decade.¹ Farms in the western cotton region were being consolidated into large-scale units which under prevailing labor conditions could be operated more cheaply with hired seasonal labor than with resident tenant families.

During the war years the most rapid growth in tractor numbers took place in Georgia and South Carolina, where the rates of increase were about three times the national rate. In the period from 1945 to 1950 Alabama took the lead with an increase of 168 per cent, and all of the states in this group with the exception of Oklahoma and Texas showed rates of increase at least twice the national rate.

For the decade as a whole the changes in the Southeast are even more striking. From 1940 to 1950 the South Atlantic states experienced an increase of 403 per cent in the number of tractors. In the East South Central states the increase was 417 per cent. The rate of increase in the West South Central states had meantime slowed down to 154 per cent, although this was still above the national average of 131 per cent.

Changes in the Tractor-Land Ratio

The increased use of tractors in the South has brought about a more uniform dispersion of mechanical power in relation to crop acreage in the United States. This is revealed in Table 4. During the twenties the cotton states, with the exception of North Carolina, remained well below the national average of tractors per thousand acres of harvested cropland. By 1940 Oklahoma and Texas, despite their vast acreages, were beginning to approach the national average, while the eastern cotton states still showed little progress. By the end of the recent decade, however, the number of tractors in relation to harvested cropland had increased sufficiently in the southeast so that Georgia and Mississippi were where Iowa had been in 1945 (8.4 tractors per thousand acres), with Alabama running close behind. There was a pronounced tendency for the disparities in the distribution of tractors in

1. Cf. Paul S. Taylor, *Power Farming and Labor Displacement in the Cotton Belt, 1937* (Washington: U.S. Bureau of Labor Statistics, Serial No. R. 737, 1938), 7; Eugene G. McKibben and R. Austin Griffin, *Changes in Farm Power and Equipment: Tractors, Trucks, and Automobiles*, W.P.A. National Research Project Report No. A-9 (Philadelphia: Works Progress Administration, December, 1938), 25-26.

relation to cropland to become reduced as the rates of increase in states which had early taken the lead began to decline. Among the cotton states, North Carolina, Louisiana, and Tennessee had caught up with the national average by 1950, and Arkansas was close behind.

Changes in the Tractor-Man Ratio

Another significant indicator is the growth in the number of tractors in relation to workers employed on farms. An increase in this ratio means that the workers engaged in agriculture have a greater amount of mechanical power at their disposal. If effectively used, this power should result in an increase in their average productivity.

All of the southern divisions show steady gains in the number of tractors per thousand workers employed on farms from 1925 to 1950, with the most rapid gains coming in the last ten years of the period (Table 5).² However, as compared with other regions of the country, the end of World War II found the South still lagging severely in the tractor-man ratio, and this lag was only moderately relieved during the following five-year period. In 1945 there was only one tractor to every nineteen farm workers in the East South Central states and one to every fourteen workers in the South Atlantic states, while the North Central states had nearly achieved one tractor to every two farm workers. In the West South Central states at this time there was one tractor to every five farm workers.

By 1950 the eastern portion of the cotton region had reached a tractor-man ratio that was about what it had been in the middle western states twenty years earlier. The western portion of the region was still considerably in the lead, partly because of the continued introduction of tractors, but mainly because of the relatively greater decline in workers employed on farms.

The figures in Table 5, when compared with those of Table 4, suggest what is made clearer below: that under partial mechanization cotton remains a labor intensive crop. Under total mechanization this is no longer true.

2. Data on farm employment necessary to calculate this ratio are not available by states or for earlier years. It should also be borne in mind that because of variations in the seasonal character of farm employment and in tractor sizes this ratio is only a crude indicator of regional differences in the application of human and mechanical power.

Table 4

NUMBER OF TRACTORS PER THOUSAND ACRES OF CROPLAND HARVESTED,
UNITED STATES, DIVISIONS, AND TEN COTTON STATES, 1920-1950

Divisions and States	Number of tractors per 1,000 acres of cropland harvested					
	1920	1925	1930	1940	1945	1950
United States	.7	1.5	2.6	4.9	6.9	10.5
New England	.6	1.8	3.9	8.4	13.5	22.4
Middle Atlantic	.8	3.0	5.7	9.4	14.2	22.2
East North Central	.9	2.5	4.4	7.9	10.5	15.0
West North Central	.8	1.2	2.3	4.7	5.7	7.7
South Atlantic	.4	1.1	1.7	2.2	4.9	11.4
East South Central	.2	.6	1.0	1.6	3.6	9.6
West South Central	.4	.7	1.3	3.4	5.4	8.6
Mountain	1.1	1.0	2.1	4.1	5.2	8.1
Pacific	1.6	3.5	4.8	7.0	9.3	15.1
North Carolina	.4	1.4	2.0	2.1	5.1	12.7
South Carolina	.2	.7	.8	1.1	3.0	7.6
Georgia	.2	.5	.7	1.1	3.2	8.5
Tennessee	.3	.8	1.1	1.9	4.1	10.7
Alabama	.1	.4	.7	1.1	2.8	8.0
Mississippi	.1	.3	.8	1.5	3.3	8.4
Arkansas	.3	.6	.9	1.9	4.4	10.2
Louisiana	.7	1.0	1.2	2.3	5.1	11.4
Oklahoma	.4	.8	1.7	3.6	5.0	7.9
Texas	.4	.6	1.2	3.8	5.9	8.3

SOURCE: U.S. Bureau of the Census, *U.S. Census of Agriculture: 1950*. Vol. II, *General Report*, Statistics by Subjects (Washington: Government Printing Office, 1952), Table 15.

Principal Uses of the Tractor Under Partial Mechanization

How has the tractor been most intensively used under varying applications of partial mechanization in cotton production? Table 6 makes a comparison by states of the application of tractor power in cotton raising for the prewar year 1939 with the postwar year 1946. The principal tasks to which tractors were being applied were land breaking, seedbed preparation, planting, and cultivating. In all areas except the Far West there were substantial increases during these years in the percentage of each task performed with tractor power. The only reason the Far West was an exception in rates of increase was

Table 5

NUMBER OF TRACTORS PER THOUSAND FARM WORKERS,
UNITED STATES AND DIVISIONS, 1925-1950

Divisions	Number of tractors per thousand farm workers *				
	1925	1930	1940	1945	1950
United States	39	74	143	242	386
New England	28	52	121	240	351
Middle Atlantic	66	119	187	329	464
East North Central	81	153	272	437	637
West North Central	74	153	298	435	605
South Atlantic	13	21	30	72	166
East South Central	7	11	24	56	144
West South Central	15	33	100	198	343
Mountain	38	88	159	270	484
Pacific	71	106	143	211	371

SOURCE: U.S. Bureau of the Census, *U.S. Census of Agriculture: 1950*. Vol. II, *General Report*, Statistics by Subjects (Washington: Government Printing Office, 1952), Table 15; Special Statistics Branch, U.S. Agricultural Marketing Service.

* Ratio of all tractors on farms to average annual employment of all farm workers (revised series).

that the use of tractors was already so prevalent in this region before the war.

In California cotton production 85 per cent of the land breaking, 71 per cent of the harrowing, 71 per cent of the planting, and 73 per cent of the cultivating were already being done with tractor power by 1939. The figures for Arizona are similar. In contrast, farmers in the southeastern states were performing only 10 per cent of their land breaking, 8 per cent of their harrowing, 2 per cent of their planting, and 2 per cent of their cultivating by tractor at this time.

By 1946 the percentages of these operations performed with tractors in California had risen to 97 for land breaking, 95 for harrowing, 85 for planting, and 90 for cultivating. In 1949 it was possible for one observer to say,

I had the pleasure of watching a small farmer near Fresno furrowing out for irrigation with a horse drawn walking plow and I could not help but

meditate on the unique position of the West in its efforts toward mechanization. I do not believe that there was another horse drawn piece of equipment on a cotton farm in the whole of the San Joaquin Valley, in which there is being cultivated some 954,000 acres of cotton this year.³

Table 6

USE OF TRACTOR POWER FOR PREPARING SEEDBED, PLANTING, AND
CULTIVATING COTTON, SIXTEEN COTTON STATES, 1939 AND 1946

State and State group †	Percentage of							
	Land breaking done with tractors		Harrowing done with tractors		Planting done with tractors		Cultivating done with tractors	
	1939	1946	1939	1946	1939	1946	1939	1946
	%	%	%	%	%	%	%	%
Virginia	17*	58	12*	49	2*	23	3*	14
North Carolina	14	47	9	33	1	13	1	8
South Carolina	14	42	9	31	1	12	1	10
Georgia	7	36	8	30	1	12	1	10
Florida	7*	25	8*	23	1*	12	1*	6
Alabama	10	33	7	25	3	15	5	14
Southeast	10	38	8	29	2	13	2	11
Mississippi	16	35	13	32	6	16	7	16
Louisiana	15	46	11	39	3	18	4	21
Arkansas	14	42	13	38	3	15	6	14
Tennessee	16	44	14	34	1	8	6	16
Missouri	24	76	20	61	4	30	13	55
Mid-South	16	42	13	37	4	16	6	18
Oklahoma	44	81	38	78	28	69	25	73
Texas	49	85	40	82	45	80	43	83
Southwest	48	84	40	81	42	78	40	82
New Mexico	49	86	34	70	39	70	41	80
Arizona	89	94	77	88	65	80	76	85
California	85	97	71	95	71	85	73	90
Far West	81	94	67	89	64	81	69	87
Average	30	60	25	54	21	43	21	45

SOURCE: A. P. Brodell and J. A. Ewing, *Use of Tractor Power, Animal Power, and Hand Methods in Crop Production* (Washington: Bureau of Agricultural Economics FM-69, July, 1948), 27.

* No reports received from crop correspondents. Estimates based largely on reports from adjacent or nearby states.

† The sixteen states listed had more than 99.9 per cent of the U.S. cotton acreage in 1939 and 1946.

3. Ray Provost, "Observations on Efficiencies in Cotton Farming: In the West," *Proceedings of the Third Annual Beltwide Cotton Mechanization Conference*, 145.

It may be added that during the three years in which this conversion to power farming was being completed the acreage of cotton under cultivation in California was being increased by about 160 per cent.

The extent of use of tractors in the Southeast by 1946 was not nearly so spectacular, but the significant aspect of change was that the percentages of operations conducted by tractor had tripled or better in every state. Thirty-eight per cent of the land breaking, 29 per cent of the harrowing, 13 per cent of the planting, and 11 per cent of the cultivating were done with tractors in the Southeast in 1946. Since the number of tractors in these states has greatly increased since that date, it may be presumed that correspondingly higher percentages of the crop operations have been mechanized, with the greatest increases taking place in plowing and disking, the stages of production most easily converted to power application.

The states lying between California and Georgia, representing the extremes in degree of mechanization, in general display intermediate stages of tractor application, although as would be expected the western portions of Texas and Oklahoma and the Delta area are considerably ahead of the areas which border them.

THE EXTENT OF COMPLETE MECHANIZATION

As the tractor is the symbol of partial mechanization, the mechanical harvester is the symbol of complete mechanization. Again, this may be misleading, as the description in the preceding chapter of other necessary elements in the production process has shown. However, in areas where cotton harvesters have been introduced in numbers for commercial use, rather than merely for experimental demonstration, total mechanization has either been achieved or is close at hand.

No complete figures are so far available on the distribution of cotton harvesters by states, but the National Cotton Council's compilation of estimates by state extension service representatives indicates that for the 1955 harvest about 32 per cent of the over 18,000 spindle pickers in use were operated in California, 14 per cent in Arkansas, 14 per cent in Mississippi, 11 per cent in Arizona, 8 per cent in Texas, 7 per cent in Missouri, 6 per cent in Louisiana, and the remaining 8 per cent in other states. About 84 per cent of the over 23,000 mechanical strippers were in use in Texas, 12 per cent in Oklahoma, and the re-

maining 4 per cent thinly scattered in New Mexico and the southeastern states.

Table 7 shows the growth in the portion of the American cotton crop harvested mechanically by all methods, as revealed in ginners' reports. For the years through 1947 the percentages harvested by machine were quite small, and represented mainly the stripping of cotton in the High Plains of Texas. Since 1948, however, when 6 per cent of the crop in the Far West was mechanically harvested, the part of the crop handled by machine has grown appreciably. In 1947 2 per cent of the American crop was mechanically harvested; two years later this had risen to 6 per cent, and six years later to 22 per cent. During most of this period, except for 1950, the size of the cotton crop was also increasing, so that the absolute amount of cotton mechanically harvested in 1953 was more than fifteen times the amount so harvested six years earlier.

The outstanding gains in mechanical harvesting have occurred in the West—especially in the irrigated areas of California and Arizona, where the spindle picker has been chiefly used. In 1955, 67 per cent of the California crop was harvested by machine, and 39 percent of the Arizona crop. Texas ranked fifth in the percentage (24 per cent) of its total crop mechanically harvested, but because of its size the state has in recent years followed California a close second in the absolute number of bales of cotton harvested by machine. (In 1955 more mechanically harvested cotton was ginned in Texas than in California.) In the Mid-South Louisiana has led in percentages, but for the past two years Mississippi and Arkansas have actually harvested more cotton by machine.

According to information compiled for last year, the 23 per cent of the American crop that was mechanically harvested was broken down into 17 per cent harvested by spindle pickers and 6 per cent by strippers. Most of the stripped cotton was harvested in Texas, Oklahoma, and New Mexico, and spindle pickers were used almost exclusively in the rest of the region. Because of its size and cost, the spindle picker has been most effectively used on large acreages, although smaller models are now in production. Increasing attention is being given to the problem of mechanizing production on smaller farms throughout the region.

This has raised the question whether the mechanical stripper can be effectively utilized in other areas besides the High Plains. Indications

Table 7

PERCENTAGE OF COTTON CROP MECHANICALLY HARVESTED,
UNITED STATES AND SIXTEEN COTTON STATES, 1945-1955 *

Area	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
	%	%	%	%	%	%	%	%	%	%	%
United States	1	†	2	3	6	8	15	18	22	22	23
<i>Southeast</i>	†	†	†	1	†	†	2	2	5	3	2
Alabama					†	†	†	1	3	2	†
Florida					0	0	1	4	12	4	6
Georgia					†	†	2	3	6	3	3
North Carolina					†	†	1	1	3	3	2
South Carolina											
Virginia					1	†	3	1	7	4	2
					0	0	0	0	0	0	0
<i>Mid-South</i>	1	†	†	2	2	2	5	6	13	15	22
Arkansas					1	1	2	2	9	16	25
Louisiana					†	3	11	13	34	28	28
Mississippi					4	3	7	7	13	11	23
Missouri					2	†	1	6	13	22	24
Tennessee					†	†	†	1	1	1	2
<i>Southwest</i>	3	2	6	6	10	12	18	22	24	21	24
Oklahoma					2	6	13	17	19	15	20
Texas					11	12	19	22	24	21	24
<i>Far West</i>	†	1	†	6	9	23	41	50	53	50	52
Arizona					4	9	26	46	54	44	39
California					13	34	53	59	59	62	67
New Mexico											
					3	1	7	12	15	10	16

SOURCE: U.S. Agricultural Marketing Service (formerly U.S. Production and Marketing Administration), *Charges for Ginning Cotton, Costs of Selected Services Incident to Marketing, and Related Information* (Washington: U.S. Department of Agriculture, annual reports for indicated years).

* Includes machine picking and machine stripping. Data by states not available before 1949.

† Less than 0.5 per cent.

are not highly encouraging for the near future, but changing conditions may increase the adaptability of this type of machine. Strippers have been tried in virtually every cotton state, and have had moderate success in California, Arizona, and portions of the Piedmont. Limited experience indicates that in the hilly areas of the Southeast, where cot-

ton is small, the stripper may prove to be more effective than the spindle-type picker. It is a much less complicated machine, and therefore less expensive to buy and to keep in repair on rocky terrain. Furthermore, it is more flexible to operate on sloping land and on short, irregular contour rows. The development of a successful defoliant would make an even greater contribution to mechanical harvesting here than in the dry uplands of the West, since excess foliage is a major deterrent to the use of the stripper in the rain belt. Stripping of course adds considerably more trash to the cotton than spindle picking and does not permit repeated pickings to salvage the late opening bolls.

Against these technical considerations must also be weighed such powerful obstacles to mechanization as low-cost labor, limited capital, and very small farm units. A study of farmers' experience with strippers and spindle-type pickers in North Carolina from 1947 to 1949 concluded that although stripping was the cheaper method of mechanical harvesting (allowing for grade loss and increased ginning costs), it could not compete on small farms with hand labor at a picking wage of three dollars per hundred pounds of seed cotton.⁴ The larger the number of acres harvested, and the higher the yields, however, the more economical it became to use machines. Since the test seasons happened to be unusually wet ones and therefore generally unfavorable to the use of machines, it is possible that mechanical harvesting has made a more favorable showing in subsequent years. In any event it will take a number of years to make necessary adaptations in strippers and to install additional cleaning equipment in local gins before this method of harvesting can be extensively used in areas outside the western uplands.

4. Actual rates for hand picking varied from \$2 to \$6 per hundredweight of seed cotton, with averages of \$2.95, \$3.10, and \$2.70 recorded for North Carolina in 1947, 1948, and 1949, respectively, by the Bureau of Agricultural Economics. In cotton of average yield, it was estimated that even at a wage of \$4 per hundred, hand picking would have been more economical than machine picking unless at least 120 acres of cotton were picked per machine per season, or than machine stripping unless at least 36 acres were stripped per machine per season. In high-yielding cotton, and at the same wage rate for hand picking, machine picking would have been more economical than hand picking if 75 or more acres could be picked with each machine, and machine stripping would have been more economical if 25 or more acres could be stripped with each machine. J. Gwyn Sutherland and H. Brooks James, *Cotton Mechanization in North Carolina* (North Carolina Agricultural Experiment Station and U.S.D.A. Technical Bulletin 104, Raleigh, January, 1954), 50.

Information necessary to describe the distribution pattern for other machines and techniques associated with complete mechanization besides harvesters is not available save in fragmentary form. For example, it is known that the flame cultivator has received its most extensive trial in the Yazoo-Mississippi Delta and that about fourteen hundred of these attachments were in use in Mississippi in 1952, but estimates have not been published for other states.⁵ Similarly, as already mentioned, an estimated three million acres of cotton were treated with chemical defoliants and 300,000 acres with chemical weed killers in the fall of 1952, but information as to the pattern of introduction of these techniques by states has not been systematically compiled.

Nevertheless, it is clear that the irrigated areas of the West, the Texas High Plains, and the Mississippi Delta stand out as having made the most rapid advances in the direction of complete mechanization in recent years, and on a considerable number of individual farms in these areas that goal has undoubtedly been achieved. Phenomenally rapid progress has been made in the San Joaquin Valley of California, where land on the west side of the valley which was only recently unutilized desert has been brought under deep-well irrigation to produce cotton yields only occasionally exceeded by those of Arizona. Large-scale, fully mechanized units predominate in this area, and although there is still a substantial use of hand labor, there is a strong movement to eliminate as much of it as possible from the crop.

Mechanization may come more slowly in other parts of the region and on the smaller farms, but no part of the cotton economy can fail to be affected by the new revolution in production methods.

EFFECTS ON PRODUCTIVITY AND COSTS

Under the regional cotton mechanization research program a great number of studies have been undertaken to determine the relative effectiveness and cost savings of various degrees of mechanization as they have been put into effect in all parts of the cotton region. It would be futile to attempt to summarize these reports because of the diversity of special local conditions to which they apply. However, a

5. Letter from George Townsend, agricultural economist with the National Cotton Council, to the writer, May 5, 1952; see also Thomas L. Bagette, "Farm Engineering in Flame Cultivation," *Agricultural Engineering*, 28, No. 12 (December, 1947), 548-50.

few examples drawn from these investigations will serve to illustrate the effects on labor productivity and costs of increasing stages of mechanization.

Figure 6 shows the estimated reduction in the number of man hours required to produce a bale of cotton in the Mississippi Delta area as the methods applied progress from those long in use to the stage of complete mechanization. Under a system of mule power and half-row

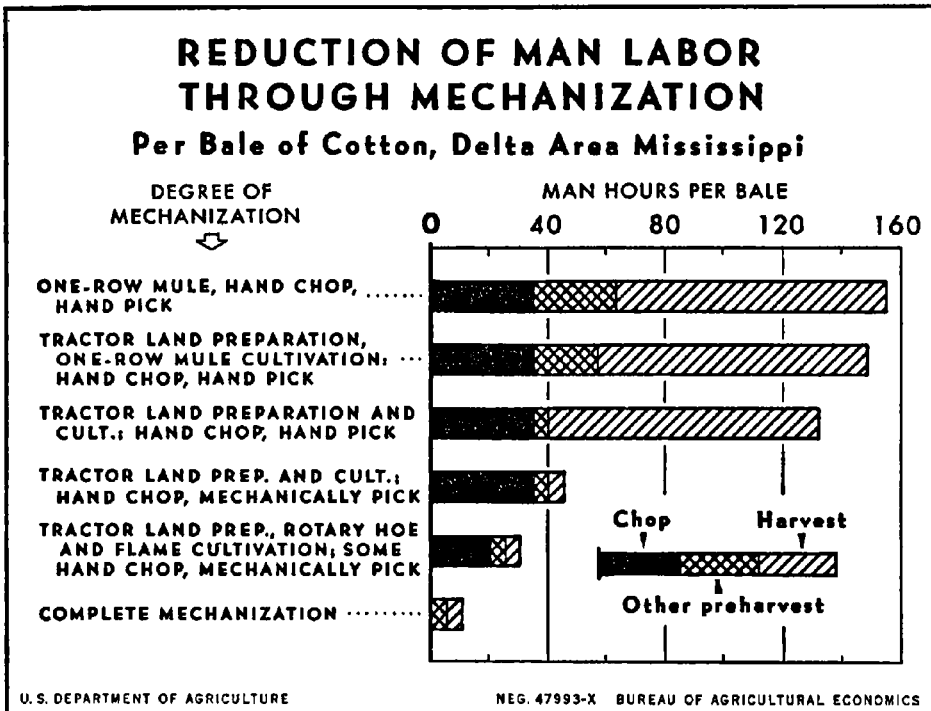


FIGURE 6

equipment, with all weeding, thinning, and picking done by hand, approximately 155 hours of man labor are required to produce a bale of cotton. Where tractor land preparation and cultivation have been introduced, the time required is cut to 132 man hours per bale. A further reduction to around thirty man hours per bale can be achieved by mechanizing as completely as possible with present equipment. This provides for some hand labor to control weeds, which would, of course, vary with the season. If an assured method of weed control is

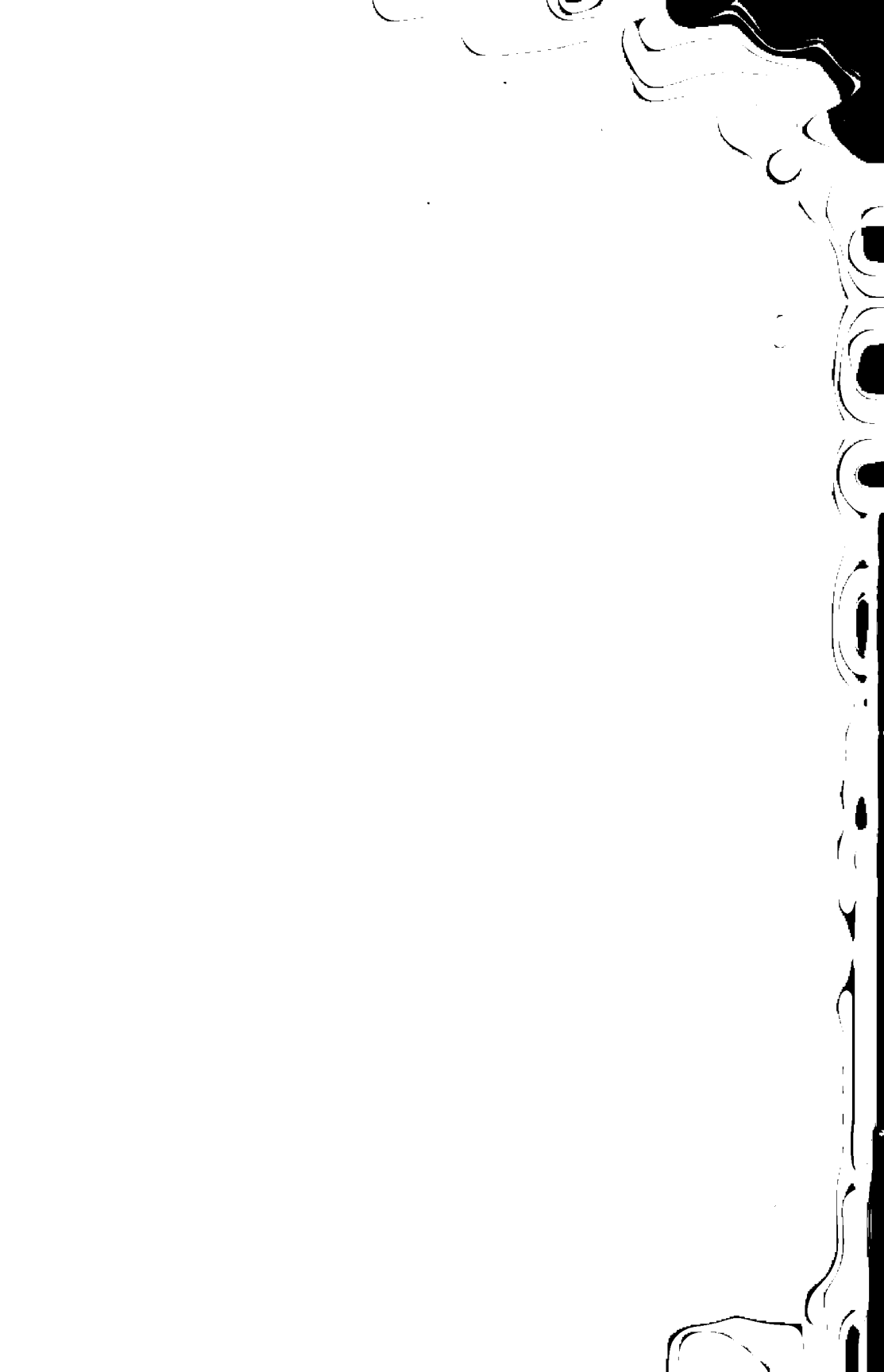
developed, it is expected that the labor requirement to produce a bale of cotton can be reduced to ten or twelve man hours.⁶

It will be observed that mechanical harvesting is by far the chief factor in reducing the man hours required to produce the crop. As we shall see below in connection with the discussion of the manpower situation on southern farms, it is of the utmost significance that mechanization of the harvest is not merely *somewhat* more convenient and labor saving than previous methods, but that it is actually *highly* labor saving. Without this preponderance of cost reduction on the side of machines, their widespread adoption might yet be in doubt.

It is too early in the introduction of total mechanization to have clear-cut demonstrations under actual commercial conditions of the comparative economic efficiency, and hence the effects on farm incomes, of the newer methods over the old. Such comparisons require a "shake-down" period for the new techniques to be tried out and perfected under varying seasonal conditions. A highly suggestive, though by no mean conclusive, pilot study indicates that one of the effects of completely mechanizing large farms may be to increase significantly the average output per worker even at the cost of lowered yields per acre.⁷ That is, mechanized cotton farming may prove to be less intensive than hand methods, and yet yield higher economic returns to the labor actually employed. This would be consistent with the experience in other mechanized crops.

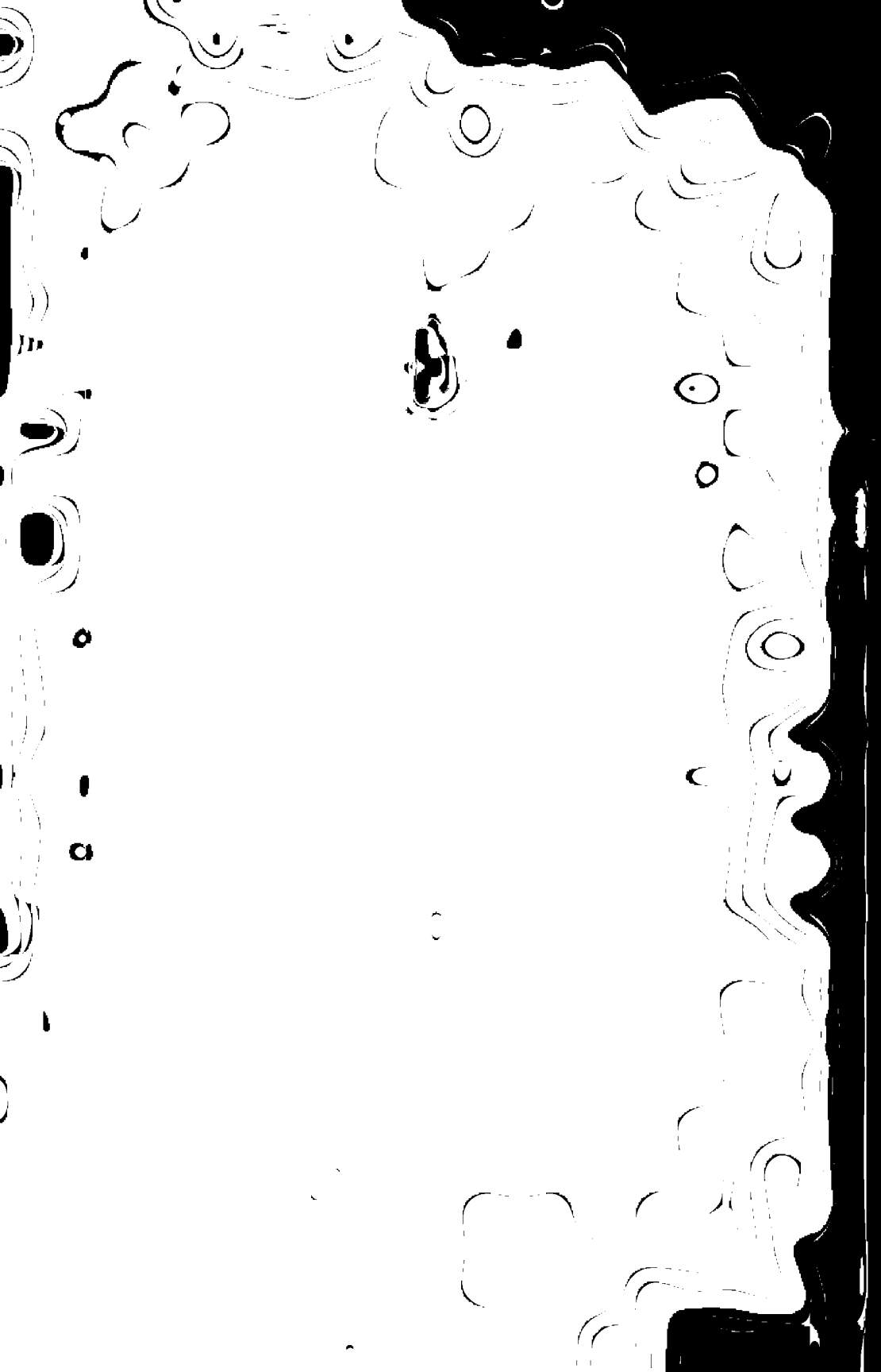
6. Cf. Grady B. Crowe, "Farm Mechanization Research in the South," *Agricultural Economics Research*, III, No. 1 (January, 1951), 6.

7. Harald A. Pederson and Arthur F. Raper, *The Cotton Plantation in Transition* (Mississippi Agricultural Experiment Station, Bulletin 508, State College, January, 1954), 22-24.



PART **3**

THE SOCIAL CONSEQUENCES



CHAPTER 9

People Leave the Land

THE PROCESS OF social adjustment which is accompanying the current revolution in methods of cotton production is an exceedingly complex one in which the cause and effect relationships are difficult to establish. One reason for this is that the transition to a mechanized agriculture in the South has been taking place during a highly disturbed period when independent forces, such as the war and the growth of nonagricultural industry, have drawn many people from the farms. The decline in farm population has in fact been so rapid that many no longer regard the displacement of farm labor by machines as a problem. On the contrary, a "labor vacuum" theory has emerged, which holds that the machines do not displace labor, but merely come in to fill the vacuum left by labor which has already departed. Thus, according to the theory, the shortage of manpower on the farms is the principal factor which is forcing the mechanization of cotton production at a rapid rate. One observer has reflected the views of many others in asserting,

Mechanization is not the cause, but the result, of economic change in the area. Most if not all of the migration of farmers and farm workers which has taken place during the past few years has resulted from factors other than mechanization itself. All over the South, tenant houses now

stand vacant on farms where mechanization has not yet achieved considerable development.¹

If this condition is indeed characteristic of the South as a whole, and if the trend should continue, certain heretofore troublesome problems would be alleviated and the fears of the past relieved. The long-needed reduction in southern farm population would seem to be taking care of itself by the most desirable avenue: voluntary departures by the people to take up more promising economic opportunities. And mechanization for greater farming efficiency could henceforth be expected to go on as rapidly as technological advances would permit.

There is much evidence to support this view, but there are also indications that the conditions for a smooth and painless transition are still very incomplete. The cotton economy and particularly the eastern portion of it has shown enormous capacity to absorb and replace, from internal sources, its manpower losses. In recent years farm operators in this area have exhibited considerable flexibility in adjusting to temporary labor stringencies without substituting the newer machines. Finally, although farm wages and incomes have been rising, there has been remarkably little improvement in the *relative* wage position of southern farm workers in comparison with those in other regions or in nonagricultural pursuits.

Accordingly, this chapter and the two following will raise such questions as these: How has the movement of population affected the long-standing abundance of low-cost farm labor in the South? Has there been an actual manpower shortage on cotton farms during World War II and the postwar period? To what extent have farm wages reflected an improvement in the position of labor on cotton farms as compared with other employment? What transitional adjustments in tenure arrangements and manpower organization have been made in response to or in anticipation of mechanization?

THE EFFECT OF THE WAR ON MANPOWER

Prior to World War II it was common to attribute much of the cityward drift of farm population to the increased mechanization of

1. Oscar Johnston, "Will the Machine Ruin the South?" *Saturday Evening Post*, 219, No. 48 (May 31, 1947), 37. The late Mr. Johnston was at the time of writing chairman of the board of the National Cotton Council of America and had for many years managed the Delta and Pine Land Company at Scott, Mississippi, one of the largest cotton plantations in the world.

farming, and under the conditions prevailing during the thirties there is no question that the "push" forces were strong in areas where mechanization, even partial mechanization, was taking place. (The acreage reduction program also played a large role in pushing population off farms.)

The war, however, induced large movements in which the "pull" forces were more evident. The most obvious of these was military mobilization, which drew over twelve million American men and women into the armed forces. About 30 per cent of these came from the sixteen states of the South.² Although a fairly high proportion of young men from southern farms was among this group, the effect of inductions into military service on the labor force was clearly a short-term phenomenon. Had this been the only, or even the most important, effect of the war, the resulting manpower deficit could probably have been offset without great difficulty by the more effective use of other manpower and resources, without stimulating the beginning of a major technological transformation in farming.³

The more significant effect of the war, however—the effect likely to have long-term consequences for the process of economic development—is that it brought about full national industrial recovery and an increased level of civilian consumption. Thus it created many opportunities for employment outside of farming while it stimulated the demand for farm goods. These and other circumstances associated with the war had the effect of vigorously stirring up the farm economy, compelling farmers to re-examine their production methods. Because incomes remained high in the succeeding years, the decade as a whole was an unusually prosperous one for agriculture. Under these conditions debt reduction and new capital investments became much more feasible than they had been during the prewar period.

2. U.S. Selective Service System, *Selective Service and Victory: the Fourth Report of the Director of Selective Service* (Washington: Government Printing Office, 1948), 588-89.

3. See, for example, the discussion of our farm manpower experience in World War II contained in the report of the President's Commission on Migratory Labor, *Migratory Labor in American Agriculture* (Washington: Government Printing Office, 1951), 27-30. The Commission pointed out that one of the reasons American farms were able to achieve record production levels during the war despite a large decline in the available number of farm hands, especially seasonal workers, was that, "We got more efficient use of our labor supply by getting more days of employment per year." See also Bela Gold, *Wartime Economic Planning in Agriculture: A Study in the Allocation of Resources* (New York: Columbia University Press, 1949), chap. VI.

In the South the war stimulated a visible acceleration in the processes of urbanization, industrialization, and economic diversification which continued into the postwar era. What might be called the incidental consequences of the war thus had the effect of exerting unusual "pulls" on the farm population which were much stronger than one might have expected if one were to have projected a "normal" course of economic development for the South based on trends discernible before the war. In order to appreciate the magnitude of the population movements and occupational readjustments which were thus set in train, it is necessary to examine several aspects of the manpower situation, including recent changes in farm population, methods of using labor, wage patterns, and tenure arrangements.⁴

FACTORS AFFECTING THE FARM POPULATION

In addition to military mobilization, already mentioned as a short-term factor, the chief influences affecting farm manpower in the South have been population movements to other regions, including importantly the departure of rural Negroes from the region; movements from farms to towns and cities within the region; and the offsetting influence of the rate of natural increase. These will be considered in turn.

Interregional Migration

The war years witnessed an upsurge of interstate and interregional population movements which were already under way in the period of partial economic recovery during the last half of the preceding decade. These movements were generally consistent with the characteristic long-term shifts of population from farms to cities, from the Deep South to the border states, and from the South to other regions, which had been temporarily arrested during the trough of the depression.

From the date of American entry into the war on December 7,

4. As will be seen below, the evidence which can be obtained is not altogether satisfactory for this purpose, both as to specific relevance and as to reliability. Wherever possible in the ensuing discussion the population data will be drawn from the 1950 Census, or from intercensal series which have been adjusted for the 1950 count. In some cases, because of the absence of other data, it will be necessary to rely upon earlier, unadjusted estimates even though changes in definition and differences in methods of gathering data render strict comparability unfeasible.

1941, until March, 1945, there was a marked increase in net civilian migration from the sixteen states of the South to the eleven western states, as compared with the prewar period from April 1, 1935, to April 1, 1940.⁵ An appreciable increase also occurred in net movement from the South to the North Central states. This represented primarily a decline in the return flow from this region which had been important during the earlier period. In contrast, population interchanges between the South and the northeastern states were relatively small.

Concealed within these broad flows were particular streams of migration for which information is incomplete but which probably had special significance for the labor supply of the Cotton Belt. Among the more important of these is the movement of the Negro farm population, historically associated with cotton raising. Of the total population of 12,866,000 Negroes in the United States in 1940, 9,905,000 (76 per cent) were in the Census South, and of these, 4,422,000 (34 per cent of the total) were on farms.⁶ By 1950 the total Negro population had grown to 15,042,000, but the number in the South remained almost stationary (10,225,000, or 68 per cent), and the number on southern farms had severely declined to 3,106,000, or 21 per cent of the total.⁷

The rate of decline in the proportion of Negroes on southern farms during the decade is in part attributable to a change in the Census definition of farm residence. A strictly comparable breakdown, which would apply the 1950 definition to the 1940 figures, is not presently available. The 1950 definition sought to secure a more satisfactory count of persons actually engaged in farming, and not merely resident on farms. It excluded from the farm population residents in the open country who were paying cash rent for their house and yard only, without farmland. In view of the seasonal use of rural nonfarm and even urban labor on cotton farms it is difficult in any case to draw

5. U.S. Bureau of the Census, *Population—Special Reports*. "Civilian Migration in the United States: December, 1941, to March, 1945," Series P-S, No. 5, September 2, 1945. Cf. Henry S. Shryock, Jr., and Hope Tisdale Eldridge, "Internal Migration in Peace and War," *American Sociological Review*, 12, No. 1 (February, 1947), 27-39.

6. U.S. Bureau of the Census, *Sixteenth Census of the United States: 1940. Population. Characteristics of the Nonwhite Population by Race* (Washington: Government Printing Office, 1943), 5, 14.

7. U.S. Bureau of the Census, *Census of Population: 1950*. Vol. II, *Characteristics of the Population*, Part I, United States Summary (Washington: Government Printing Office, 1953), Tables 59, 145.

firm conclusions about the probable occupational characteristics of southern Negroes on the basis of residence alone. The figures cited are nevertheless believed to be indicative of a significant change in the occupational orientation, as well as of a decline in the number, of Negroes in the rural South.

Differential Migration by Color

Since the time of the first World War there has been a tendency for relatively greater numbers of Negroes than of white persons to leave the southern, and particularly the southeastern, states, although there have been significant variations in the differential rates of migration. The continuation of this trend has been effecting a gradual change in the racial composition of the southern population and has tended to disperse extremely high concentrations of Negro population that had existed in some localities.⁸ The proportion of Negroes in the population of the Census South declined from 32 per cent in 1900 to 24 per cent in 1940, and to 22 per cent in 1950.⁹ Negroes comprised 27 per cent of the southern farm population in 1940, and 26 per cent in 1950 (as farm population was defined in each census).

Information concerning the changing rates of migration by racial groups must be assembled from fragmentary sources. Professor Rupert B. Vance has made a useful analysis of Census state-of-birth data which shows that by 1930, 26 per cent of the Negroes born in the Southeast (eleven states) were living in other regions, as compared with 16 per cent of all native-born population living outside the region.¹⁰ During the following decade the rate of Negro migration from the region, in which displacement from farms was an important factor, remained relatively high, while net white migration was negligible.

8. See Harald A. Pederson, *Population Trends in Mississippi* (Mississippi Agricultural Experiment Station, Bulletin 467, State College, October, 1949), for a discussion of the effects of differential migration on the concentration of Negro population within the Mississippi-Yazoo Delta and Black Belt counties.

9. U.S. Census Office, *Twelfth Census of the United States: 1900*. Vol. I, *Population*. Part I (Washington: U.S. Census Office, 1901), cxiii; U.S. Bureau of the Census, *Sixteenth Census of the United States: 1940. Population*. Vol. II, *Characteristics of the Population*. Part I, United States Summary (Washington: Government Printing Office, 1943), 54; *idem*, *Census of Population: 1950*. Vol. II, *Characteristics of the Population*. Part I, United States Summary (Washington: Government Printing Office, 1953), Tables 59, 145.

10. Rupert B. Vance, *All These People* (Chapel Hill: The University of North Carolina Press, 1945), 117. Based on the Fifteenth Census, 1930.

The net loss in white population by migration for the decade was less than 1,000 persons, while the loss in Negro population was about 425,000, representing 5 per cent of the region's Negroes.¹¹

A comparison of these figures with a special Census study of internal migration from 1935 to 1940 indicates a retardation in the rate of Negro out-migration during the latter half of the decade, while the tendency for a white inflow during the most acute years of the depression was being reversed and replaced with a growing outflow. Of the 425,000 nonwhite persons who left the Southeast from 1930 to 1940, only 110,000 left after 1935.¹² In contrast, though only about 900 white persons left the Southeast, on balance, during the entire decade, 41,000 more departed than returned during the last half.

Nevertheless, the basic pattern of a substantial Negro outflow tended to assert itself. For example, while the Census divisions of the Northeast and the South had a relatively small interchange of total population during 1935 to 1940, the Northeast had a net out-migration of 111,000 whites to the South, but a net in-migration of 39,000 nonwhites from the South.¹³ An analysis of the composition of selected migration streams from southern rural areas to northern cities for this period has revealed certain movements in which there were extremely high proportions of nonwhites among all persons leaving the South. For example, 94 per cent of the persons who moved from South Carolina farms to New York City during the years 1935 to 1940 were Negroes, as were 93 per cent of the migrants from rural Mississippi to Chicago during the same period.¹⁴

11. *Ibid.*, 126. If Texas and Oklahoma are included, the loss of white population is raised to 318,000, and of Negro population to 470,000.

12. U.S. Bureau of the Census, *Sixteenth Census of the United States: 1940. Population. Internal Migration, 1935 to 1940. Color and Sex of Migrants* (Washington: Government Printing Office, 1943), 19. This was the first census to secure information necessary to establish a count of migration during a fixed period of time. All earlier studies of internal migration for the United States are estimates, usually based on state-of-birth or age-group data. Although the figures analyzed by Vance are therefore not strictly comparable with those of the Census study, it is believed that neither the order of magnitude nor the direction of flows is seriously misrepresented by this comparison. Wherever the Census designation "nonwhite" is used in this and the ensuing discussion, it may be taken as virtually equivalent to "Negro," since the proportion of other nonwhites in the particular migrant streams considered is negligible.

13. Shryock and Eldridge, "Internal Migration in Peace and War," 29.

14. *Ibid.*, 32.

It is noteworthy that there was a slight predominance of Negro females in these movements, probably occasioned by the openings in domestic service in northern cities. This preponderance is believed to have been accentuated during the war, when males in the age groups which normally show the highest migration rates were being drawn into the armed services. Since Negro women form an important part of the seasonal labor supply in chopping and picking cotton in most parts of the South, it is probable that the continued siphoning of this group from the farms has contributed to a decline in the available seasonal labor force in recent years.

Although Negroes lagged in out-migration during the early years of the war, they later tended to catch up with white persons in the rate of departure. Negroes were not only more mobile during this period (late war and immediate postwar); they traveled longer distances, as indicated by the fact that moves between states increased more rapidly than moves within states. They also tended to shift their points of destination. The Pacific states, which had attracted surprisingly few Negroes among the numerous in-migrants of the 1930's (possibly because of the long travel distances from the Southeast), experienced a considerable influx of southern nonwhites during the war. Five congested production areas on the West Coast showed a combined increase of 213 per cent in Negro population between 1940 and 1944.¹⁵

How are these differential rates of migration to be explained? The primary forces influencing Negro migration from the South during the first half of the 1930's appear to have been various factors on the "push" side: displacement by mechanization and the operation of the AAA program; low economic opportunity; and competition with white population returning to farms. Later, with partial recovery, the first opportunities at nonfarm employment tended to go to white persons, who resumed their normal pattern of outflow. It was only secondarily, and after acute wartime manpower shortages had developed in the industrial cities, that southern Negroes experienced a strong "pull," and that the rate of Negro outflow began to catch up.

Of course push and pull factors are operative at all times, and the

15. *Ibid.*, 32. Based on U.S. Bureau of the Census, *Population*. "Characteristics of the Population, Labor Force, Families, and Housing; Congested Production Areas," Series CA-3, July 20 to October 7, 1944.

intention here is merely to emphasize shifts in the degree of relative importance attaching to each.

In focusing attention on the increased interregional mobility of southern Negroes in recent decades it must not be overlooked that for the overwhelming majority of the group there has not been sufficient attraction outside, or dissatisfaction with conditions within, to lead to the rather drastic step of a long-distance move into another region. Of the total nonwhite civilian population in the Census South in April, 1947, 84 per cent were classified as nonmigrants (that is, had not left the county in which they were residing in April, 1940), and 45 per cent were living in the same house as in 1940.¹⁶ Among the 16 per cent who migrated, 9 per cent remained within the same state, and only 2 per cent moved between noncontiguous states. The inertia factors accounting for geographic immobility remain strong, and it is extremely likely that changes in relative economic opportunities in local areas and nearby urban communities (the evidence for which is somewhat more difficult to secure) have played a much greater role in inducing southern farm workers to change their occupations than the opportunities requiring long-distance moves and unusual sources of information.

Urbanization Within the South

In addition to interregional migration, therefore, the second and probably more important factor influencing the farm population and labor supply in the Cotton Belt has been the rapid growth of cities and other urban communities within the region. Here again a trend already evident before the war was continued and accelerated. During the thirties the South showed vigorous gains in urban population, while cities in the more densely populated parts of the United States were failing to maintain their earlier rates of growth. The South continued to lead the Northeast and North Central states in rates of urbanization during the forties, although by this time the West was showing even higher rates of increase (Table 8). While urban population increased by 7 per cent in the Northeast and by 15 per cent in the North Central states from 1940 to 1950, it increased by 36 per cent in the

16. U.S. Bureau of the Census, *Current Population Reports—Population Characteristics*, "Internal Migration in the United States: April, 1940, to April, 1947," Series P-20, No. 14, 21. The comparable figure for white nonmigrants is 77 per cent, and for white persons living in the same house as in 1940, 39 per cent.

Table 8

PERCENTAGE DISTRIBUTION AND PERCENTAGE CHANGE OF URBAN POPULATION, UNITED STATES, REGIONS, AND DIVISIONS, 1930-1950 *

Geographic area	Urban population Percentage distribution			Percentage change	
	1930	1940	1950	1930- 1940	1940- 1950
United States	100%	100%	100%	7.9	19.5
<i>Northeast</i>	38.7	37.0	33.2	3.2	7.2
New England	9.1	8.6	7.8	1.7	7.8
Middle Atlantic	29.6	28.4	25.4	3.7	7.1
<i>North Central</i>	32.5	31.5	30.4	4.9	15.2
East North Central	24.4	23.4	22.5	3.9	14.6
West North Central	8.1	8.1	7.9	7.9	17.1
<i>South</i>	18.7	20.6	23.4	18.5	35.9
South Atlantic	8.3	9.3	10.1	21.5	30.0
East South Central	4.0	4.3	4.6	13.9	28.9
West South Central	6.4	7.0	8.7	17.5	48.0
<i>West</i>	10.1	10.9	13.0	16.2	42.5
Mountain	2.1	2.4	2.8	21.5	39.8
Pacific	8.0	8.5	10.2	14.8	43.3

SOURCE: U.S. Bureau of the Census, *Census of Population: 1950*. Vol. II, *Characteristics of the Population*, Part I, United States Summary (Washington: Government Printing Office, 1953), Table 15.

* Data for all years adjusted to fulfill 1940 definition of urban population.

South.¹⁷ As a consequence, the South, which had increased its proportion of the nation's urban population from 19 per cent in 1930 to 21 per cent in 1940, increased it further to 23 per cent in 1950, while the proportions in the Northeast and North Central states declined. The greatest growth of cities within the region occurred in the West

17. This comparison employs the 1940 Census definition of urban territory, in which the most important component is the group of incorporated places having 2,500 inhabitants or more, with special rules to include similar populations in unincorporated places and in minor civil divisions adjacent to cities. In 1950 the definition was refined to include in urbanized areas certain large and closely built-up places which would formerly have been classified as rural. The net effect of the change in definition is to transfer about 5 per cent of the total population from rural to urban classification. The application of the new definition to the 1950 data in Table 8 (comparable data for 1930 and 1940 not being available) would tend to raise somewhat the rate of increase in urban population for the West, and lower it somewhat for the North Central states.

South Central states, where the increase in urban population for the decade was 48 per cent.

From which parts of the region did the cities drain population? On the basis of the registration for War Ration Book Four in November, 1943 (by which time the heaviest wartime migration had occurred), it has been possible to determine the counties of origination and destination of civilian movements during this period.¹⁸ Between 1940 and the end of 1943 the total civilian population in the United States shrank by an estimated 4,021,000 persons (military inductions minus natural increase). For the South the decline was 1,422,000 persons. As might be expected, the heaviest drain was from the rural counties, although some metropolitan counties also lost population. In the cotton states, the areas experiencing the greatest losses were rural counties in Oklahoma and Texas (except for the High Plains, which showed surprising gains), the hilly areas of Arkansas, Mississippi, and Alabama, and the coastal plains of southern Alabama, Georgia, and South Carolina. The alluvial areas in general had smaller declines, and the western irrigated areas actually experienced increases, although this trend did not persist throughout the entire war, and did not necessarily benefit employers seeking cotton labor.

Of the forty-eight metropolitan areas in the South, thirty-nine gained in population during this period. Most of the gains were registered in seaport and shipbuilding areas. Savannah grew 29 per cent, Charleston 37 per cent, Norfolk 57 per cent, and Mobile 61 per cent. There were also increases at scattered industrial centers in the interior. In the postwar era these cities, with the exception of Charleston, retained the greater part of their wartime population gains. In addition, the 1950 census recorded exceptional increases for the southwestern cities of Baton Rouge, Houston, San Antonio, Dallas, and Fort Worth.

The Net Decline in Farm Population

The combined result of military inductions, interregional migration, and movement to cities within regions during the war was the sharpest reduction in farm population ever witnessed in this country within a similar period. The South was the region with the heaviest losses. From 1940 to 1945 its farm population decreased by 3,347,000, or 20

18. U.S. Bureau of the Census, *Population—Special Reports*, "Estimated Civilian Population of the United States, by Counties: November 1, 1943," Series P-44, No. 3, February 15, 1944.

per cent (Table 9). Nearly half of the decline took place within one year, 1942, when 1,473,000 persons left southern farms, over and above those who returned.¹⁹ Within the region, the West South Central division had the highest rate of decline, losing a fourth of its farm population from 1940 to 1945. In the other two southern divisions the loss was between a fifth and a sixth of the 1940 population.

Table 9

NUMBER AND PERCENTAGE CHANGE IN FARM POPULATION,
UNITED STATES, REGIONS, AND DIVISIONS, 1940-1950

Area	Farm population (thousands)			Percentage change		
	1940	1945	1950	1940-1945	1945-1950	1940-1950
United States	30,547	25,295	25,058	-17.2	-0.9	-18.0
<i>Northeast</i>	2,411	2,150	2,097	-10.8	-2.5	-13.0
New England	623	607	494	-2.6	-18.6	-20.7
Middle Atlantic	1,788	1,543	1,603	-13.7	3.9	-10.4
<i>North Central</i>	9,349	7,942	8,005	-15.0	0.8	-14.4
East North Central	4,638	3,895	4,092	-16.0	5.0	-11.8
West North Central	4,711	4,047	3,913	-14.1	-3.3	-16.9
<i>South</i>	16,400	13,053	12,793	-20.4	-2.0	-22.0
South Atlantic	6,060	5,034	5,055	-16.9	0.4	-16.6
East South Central	5,283	4,275	4,315	-19.1	0.9	-18.3
West South Central	5,057	3,744	3,423	-26.0	-8.6	-32.3
<i>West</i>	2,387	2,150	2,163	-9.9	0.6	-9.4
Mountain	1,118	1,012	927	-9.5	-8.4	-17.1
Pacific	1,269	1,138	1,236	-10.3	8.6	-2.6

SOURCE: U.S. Agricultural Marketing Service, *Farm Population: Annual Estimates by States, Major Geographic Divisions, and Regions, 1920-50, and for the United States, 1910-50* (Washington: U.S. Department of Agriculture, November, 1953), 12.

By the spring of 1946 a resurgence of farm population had begun to set in. Military demobilization and the reduction of employment on war production were important factors in this return flow. A question frequently asked at the time was, how serious would the problem of relocating uprooted farm families be when things settled down in the postwar period? It was recalled that after the first World War many

19. U.S. Agricultural Marketing Service, *Farm Population: Annual Estimates by States, Major Geographic Divisions, and Regions, 1920-50, and for the United States, 1910-50* (Washington: U.S. Department of Agriculture, November, 1953), 12-14.

returning servicemen from the grain states had been left unemployed by the transformation in methods of wheat raising which had occurred in their absence, and the effects of which were intensified by the collapse of the wartime demand for foodstuffs. Was this experience to be repeated on a more widespread scale following World War II?

As it turned out, the postwar "Back to the Farm" movement lasted less than two years, from the end of the war until about the end of 1946. Actually there were large movements in both directions during this period, but for a time the return of men from the armed forces greatly outweighed the departures from farms. For the country as a whole it is estimated that three of every four farm men who went to war returned to farming by January 1, 1947.²⁰ The remainder represented men whose term of service had not yet expired, who had re-enlisted, or who had simply not returned to farms. Many of those who did return did not stay long. By 1947 the South Atlantic and East South Central states had regained only about two-fifths of their losses of farm population since 1940, and the West South Central states only about one-eighth.²¹

In succeeding years, as a result of the continuation of favorable employment opportunities off the farm, the normal trend of rural-urban outflow was restored. This outflow was sufficient to overbalance an unusually high rate of natural increase, resulting in part from the postwar upsurge in the number of births and in part from a significant decline in the death rate.²²

For the region as a whole the farm population showed a decrease of 3,607,000 for the decade from 1940 to 1950, or 22 per cent (Table 9). The rate of decline was twice as high in the West South Central states as in the South Atlantic states. In the former division the number of people engaged in farming fell by one-third during the decade. In terms of the available farm labor force the loss was no doubt even greater, since the departures from the farms tended to be concentrated in the vigorous young adult age groups, while the partially offsetting increase included a large proportion of the very young.

20. Margaret Jarman Hagood, "More People on Farms," *Agricultural Situation*, 31, No. 9 (September, 1947), 1.

21. *Farm Population: Annual Estimates by States, Major Geographic Divisions, and Regions, 1920-50, and for the United States 1910-50*, 12-14.

22. Margaret Jarman Hagood, "Big Baby Crop, Low Death Rate Boost Farm Population," *Agricultural Situation*, 33, No. 8 (August, 1949), 9.

CHANGES IN FARM EMPLOYMENT

How was farm employment in the Cotton Belt affected by the decline in farm population during the 1940-1950 decade? Unfortunately the available statistics on farm employment are of rather limited usefulness because of deficiencies in the way the data are gathered and in the definition of farm employment.

The information on which the Department of Agriculture bases its farm employment series is gathered by the crop reporter system and is subject to uncertain reliability because of the doubtful representativeness of the sample which is thus secured.²³ Of at least equal importance for the purposes of this study, however, is the inadequacy of the definition of employment which is applied. The description of the two categories of employed farm workers reads as follows:

All farm operators are counted as employed if they spend one hour or more during the survey week at farm work, chores, or in the transaction of farm business. Members of the operator's family or household doing *unpaid* farm work, or chores, are counted if they put in 15 hours or more during the survey week. Operators plus unpaid members of their families or households who meet these criteria of employment are called family workers. All persons doing one or more hours of farm work or chores for pay during the survey week are counted as hired workers. Members of the operator's family doing farm work for cash wages are counted as hired workers. Croppers are considered family workers when working on their own crops, but hired workers when doing farm work for pay off their own tracts. If a person is employed both as a family worker and a hired worker during the week on the same farm he is counted as a hired worker.²⁴

The application of such a definition of employment is not likely to reflect very sensitively the number of man-hours or man-days actually available to and utilized by employers of farm labor in a given period because no distinction is made between an underemployed worker

23. Analysts in the Bureau of Agricultural Economics from time to time indicated that they were aware of this deficiency, but it was apparently outweighed by the increased cost which would have been involved in improving the method of gathering data. The problem of interpreting such information is alluded to again below in a note on the reliability of farm wage data.

24. U.S. Bureau of Agricultural Economics, *Farm Labor*, March 9, 1951, 3.

who works only a few hours in a week and a fully employed worker. A casual worker who works on more than one farm during the survey week may be counted more than once and yet not complete a full week's work.²⁵

It must also be borne in mind that changes in the size of the cotton crop from year to year and changes in weather conditions during critical seasons may importantly affect farm employment irrespective of the labor force available. Furthermore, annual averages do not reveal the extremes of peak demand which may distinguish one crop season from another.

The Decline in Farm Employment

With the qualifications noted, the data summarized in Table 10 appear to confirm the general finding of a fairly continuous decline in labor availability in each of the principal cotton areas during the war years, with the exception of the moderately heavy crop year of 1942, when labor was still plentiful. The decline in employment, especially among hired workers, was most noticeable in the Delta states of Mississippi, Arkansas, and Louisiana, where the use of hired workers showed a drop from 1940 to 1945 of 28 per cent, and total employment fell 14 per cent. In the Eastern Cotton area (South Carolina, Georgia, and Alabama), employment of hired workers declined 17 per cent and total employment 8 per cent during the same period; in the Western Cotton area (Texas and Oklahoma), employment of hired workers declined 19 per cent and total employment 9 per cent.

In the immediate postwar years employment temporarily increased, though it failed to reach the levels of the recovery years immediately preceding the war; and thereafter it continued to decline even during the unusually large crop year of 1949. For the entire decade from 1940 to 1950, the Eastern Cotton area showed a decline in total farm employment of 15 per cent, the Delta area a decline of 17 per cent, and the Western area a decline of 15 per cent. As in the earlier part of the decade, the greatest declines were in the employment of hired workers.

25. A somewhat more restricted definition of farm employment is used by the Bureau of the Census in arriving at the estimates published in the *Monthly Report on the Labor Force*. For various reasons, however, including the limited breakdowns available, these estimates are probably no more satisfactory for the present purpose than the U.S.D.A. figures.

Table 10

NUMBER AND PERCENTAGE CHANGE IN FARM EMPLOYMENT BY
TYPE-OF-FARMING AREAS, COTTON REGION, 1940-1950

	Number employed (thousands)			Percentage change		
	1940	1945	1950	1940- 1945	1945- 1950	1940- 1950
<i>Eastern Cotton Area *</i>						
Family workers	1,230	1,158	1,056	-5.9	-8.8	-14.1
Hired workers	337	279	281	-17.2	0.7	-16.6
Total employed	1,567	1,437	1,337	-8.3	-7.0	-14.7
<i>Delta Cotton Area †</i>						
Family workers	1,013	915	856	-9.6	-6.4	-15.5
Hired workers	338	245	270	-27.5	10.2	-20.1
Total employed	1,351	1,160	1,126	-14.1	-2.9	-16.7
<i>Western Cotton Area ‡</i>						
Family workers	741	705	660	-4.9	-6.4	-10.9
Hired workers	300	242	224	-19.3	-7.4	-25.3
Total employed	1,041	947	884	-9.0	-6.7	-15.1

SOURCE: Division of Special Farm Statistics, U. S. Bureau of Agricultural Economics.

* South Carolina, Georgia, and Alabama.

† Mississippi, Arkansas, and Louisiana.

‡ Oklahoma and Texas.

One of the shortcomings of these data, in addition to those already noted, is that they fail to reveal the changes in the composition of the farm labor force which is enumerated. During the war years there was a considerable substitution of women, children, part-time workers, new and inexperienced workers, and older individuals for the younger, able-bodied, experienced, male farm workers who entered military service or nonfarm employment. To some extent this deterioration of the general quality of the labor force, which was probably less important in the eastern Cotton Belt than in the more mechanized areas, was offset by the tendency of farm operators and the more experienced workers to work harder, more efficiently, more hours a week and more weeks a year than before. Since the wartime conditions were temporary, it is probable that the farm labor stringency was alleviated to a greater degree by the return to a labor force of a

normal composition than the crude employment statistics suggest.²⁶ Against this must be set the fact that, in the long run, it is the younger, more able workers with greater initiative who migrate from cotton farms. Some students of the current revolution believe that this differential migration by age may have a regressive influence on the development of efficient mechanized farming.

26. A Census estimate of the composition of the agricultural labor force for the United States as a whole indicates that in 1944 about 19 per cent of the total number employed, on the average, were women 18 years of age and over, and 12 per cent were children 14 to 17 years of age. By 1950 women represented only about 15 per cent of total farm workers, and children of high-school age about 9 per cent. Figures for the South alone, if they were available, would no doubt show higher percentages for both periods. U.S. Bureau of the Census, *Current Population Reports*, "Annual Report on the Labor Force, 1950," Series P-50, No. 31, March 9, 1951, 7.

CHAPTER 10

Is There a Labor Shortage?

NOTWITHSTANDING THE NUMERICAL loss of farm manpower which has been described in the preceding chapter, it is exceedingly difficult to arrive at a satisfactory evaluation of the acuteness of the labor stringency in southern cotton areas during and since the war because of the complexity of the qualifying factors which must be considered. A comparison of changes in farm population and employment illustrates this difficulty. Table 11 shows that employment in the cotton region fell much less rapidly than did farm population during the war years even though cotton production declined from year to year. By the end of the decade employment showed only a limited response to the substantial decline in farm population. How was this possible?

UNDEREMPLOYMENT BEFORE THE WAR

Unquestionably the most important explanatory factor, for which, however, no adequate measure exists, was the substantial amount of unemployment and underemployment which was present in the region at the beginning of the war. As will be noted below in interpreting the initially sluggish movement of wartime farm wage rates, there are indications that enormous slack existed in farm production methods

as they were carried on before the war.¹ Although farm operators found it hard to alter the customary methods of organizing farm work to which they were long habituated, many ultimately succeeded in getting along with considerably less help than before. Farmers learned to cooperate more closely in swapping labor service and equipment. Many of them were able to hire on a custom basis and thus put to use more intensively such equipment as had been under-utilized in the community before.

Table 11

RELATION OF CHANGES IN FARM POPULATION TO CHANGES
IN FARM EMPLOYMENT, COTTON REGION, 1940-1950

Area	1940-1945		1945-1950		1940-1950	
	Change in farm popu- lation	Change in total farm em- ployment	Change in farm popu- lation	Change in total farm em- ployment	Change in farm popu- lation	Change in total farm em- ployment
	%	%	%	%	%	%
<i>Eastern Cotton Area</i> (South Carolina, Georgia, Alabama)	-20.6	-8.3	-1.8	-7.0	-22.1	-14.7
<i>Delta Cotton Area</i> (Mississippi, Arkansas, Louisiana)	-23.1	-14.1	0.2	-2.9	-22.9	-16.7
<i>Western Cotton Area</i> (Oklahoma, Texas)	-26.4	-9.0	-13.1	-6.7	-36.1	-15.1

SOURCE: Based on data incorporated in Tables 9 and 10.

LABOR-SAVING ALTERNATIVES

A second factor which tends to render head-counting of the labor force of uncertain significance has been the great variety of available alternative means of organizing the productive process, such as the substitution of machinery for labor, the increased use of fertilizer, and changes to less labor-intensive enterprises. Professor Bela Gold has pointed out that physical limitations on the introduction of new farm equipment due to the wartime steel shortages were by no means as

1. Cf. Louis J. Ducoff and Margaret Jarman Hagood, *Differentials in Productivity and in Farm Income of Agricultural Workers by Size of Enterprise and by Regions* (Washington: Bureau of Agricultural Economics, mimeographed, August, 1944), 8.

severe as the complaints expressed at the time by interested groups would indicate.² Despite the steel rationing program in effect during 1943 and 1944, the indices of tractor numbers and of all other machinery on American farms rose from 100 in January, 1940, to 168 in January, 1946. We have seen (in Table 3) that the number of tractors on farms in the southeastern states doubled and in some cases tripled during this period. Among the other types of farm machinery which reduced labor requirements significantly, in the enterprises to which they were applicable, were peanut pickers, grain combines, hay balers, and milking machines, all of which were produced in surprising quantity during the war years.

The reduction of cotton acreage through abandonment of marginal land or through shifts to other less intensive enterprises reduced the need for hand labor during the latter years of the war without, as we have noted, endangering the supply of cotton. Although this reduction in plantings proved to be temporary, it undoubtedly relieved the labor stringency appreciably during the most critical period.

CHANGING SEASONALITY OF LABOR DEMAND

A third and perhaps minor factor affecting an evaluation of the stringency of the farm labor situation is the changing seasonality of demand for cotton labor. Of the two periods of peak demand, hoeing and chopping in the spring, and picking in the fall, the latter requires by far the most labor. The picking season begins in June or July in the extreme southern portions of the Cotton Belt and continues through December in the northern areas, although most of the crop is harvested by the end of November. The advancing date of maturity from south to north accounts for the relatively long picking season in the entire region, but in any given local area the season usually lasts for only six to eight weeks. Until recent years the month of peak demand for picking labor tended to be October in the eastern region and September in the west, but there are indications that it is now somewhat earlier, owing to the tendency to substitute seasonal wage hands for sharecroppers and to concentrate the harvest into as short a period as possible. Although there is greater leeway in harvesting cotton than in the highly perishable crops, the loss of grade as it stands in the fields after

2. Bela Gold, *Wartime Economic Planning in Agriculture: A Study in the Allocation of Resources* (New York: Columbia University Press, 1949), 217-23.

the bolls have opened leads farmers to prefer a prompt harvest, especially if there are gangs of migrant workers available for whom the employer feels no ongoing employment responsibility. In the words of one observer,

The present day Texas cotton grower, who has discarded his plantation habits of thought, wants his cotton picked in the quickest possible time, and it makes no difference to him whether he stretches employment or not, for expenditures for labor remain the same. He, therefore, prefers a larger crew and wants it in a hurry. It is here that the Mexican workers' advantage lies, since Mexicans do not follow the harvest individually but as a group, a gang, either of individuals or of families, led and transported by the labor contractor who undertakes to supply the farmer with the entire crew he needs for his crop.³

The high cotton prices prevailing during and since the war no doubt have intensified farmers' desire to get the crop harvested with minimum loss and have contributed to keen competition for labor at the peak of the season.

CHANGING LOCAL PATTERNS OF LABOR USE

In the Southeast and in the Mid-South cotton growers have traditionally relied mainly upon resident family labor under the share-cropper system to supply most of the hired labor for the cotton harvest. There has always been some use of town labor, however, both for chopping and picking, and this has been particularly important near the larger cities with heavy concentrations of Negro population, such as Memphis.⁴ Before the war the use of migratory-casual labor was not extensive in this area, although during the depression transient job-seekers occasionally found employment in cotton-picking, and ranging groups of Mexican casuals from Texas began to appear in small numbers in the Delta. On the Atlantic seaboard there has de-

3. C. M. Evans, "Summary Report on Migratory Labor Problems," *Interstate Migration*, Hearings before the Select Committee to Investigate the Interstate Migration of Destitute Citizens, 76th Congress, 3rd Session, Part 5, September 19 and 20, 1940 (Washington: Government Printing Office, 1941), 2198.

4. In 1938 it was estimated that 15,000 Negroes left Memphis by truck every day during the season to pick cotton in adjoining parts of Mississippi, Tennessee, and Arkansas, and in the Boot Heel of Missouri. Carey McWilliams, *Ill Fares the Land: Migrants and Migratory Labor in the United States* (Boston: Little, Brown, and Co., 1942), 296.

veloped within the past twenty years an organized group of migratory harvest workers composed largely of Negro ex-sharecroppers who established their home base on the reclaimed muck lands of the Florida Everglades. They customarily work their way northward every season as far as the potato fields of Long Island or even of Aroostook County, Maine, but under the contract-labor system which prevails their employment is confined largely to truck and fruit crops. The relatively small number of prisoners of war and of workers imported from the British West Indies who were employed in agriculture during the war were similarly used almost exclusively in scattered specialty crop areas of the country, under contract to growers' associations. The eastern cotton region was apparently able to supply most of its labor needs from local sources. In a good many cases this seems to have been achieved by restoring wage workers to a sharecropper status as an incentive to stay with the crop.

In contrast, the southwestern cotton areas have made heavy use of migratory labor since the first World War and the advent of truck transportation. The weed problem, never as severe as in the eastern region, was largely overcome by the early introduction of mechanical cultivation; hence it was not necessary to maintain a large resident labor force by the sharecrop system. In Texas the annual migratory trek of cotton pickers has followed a definite pattern known as the "big swing," which accompanies the maturing harvest as the season advances. Before the war the migrant group was roughly estimated to consist of about 75 per cent Mexicans or persons of Mexican descent, 15 per cent white Americans, and 10 per cent Negroes.⁵ As described by Carey McWilliams,

"The big swing" of workers in the cotton harvest starts in the southern part of the state in June or July. From there it sweeps eastward through the coastal counties and then turns west for the central portions of the state. After the cotton has been picked in central Texas, the army splits into three units: one moves into east Texas; another proceeds to the Red River country; and a third treks westward to the San Angelo-Lubbock area. Most of the migrants who make the entire circle are Mexicans from the southern counties of the state. They tend to move west, rather than north, and skirt the old plantation area in which most of the Negro labor is concentrated . . .

5. Evans, "Summary Report on Migratory Labor Problems," 2197.

Although the army of cotton pickers is organized in the south, it gains recruits as it proceeds along the line of march. From the lower valley, where the season starts, comes the initial vanguard of about 25,000 Mexican migratory workers. As the army marches through the Robstown-Corpus Christi area, an additional 25,000 recruits join the procession. By the time the army has reached central Texas, it has probably grown to about 250,000 or 300,000 workers. Recruits join the army, follow it through a county or two, and then drop out, to be replaced with new families from the next county. By the time the army leaves central Texas, it numbers at least 400,000 workers. Not all of these workers, of course, make the complete circle; nevertheless it is estimated that at least 200,000 make the circuit covering a distance of from 1800 to 2000 miles, all within one state.⁶

In California a similar migratory pattern has been established, but the relatively greater importance of town labor in cotton production is frequently overlooked. Warren R. Bailey, regional agricultural economist of the Bureau of Agricultural Economics, has estimated that no more than 10 per cent of California cotton labor comes from outside the state, and that more than 50 per cent lives in the same county.⁷ It consists of rural-town housewives, youths, handy men, and other occasional workers who supplement their family incomes by seasonal work on nearby farms. One of the reasons for the location of a considerable resident labor force in the California cotton areas following the chaotic period of the "Okie" invasion is that the cotton crop offers a longer period of sustained employment each year than do many of the specialty crops such as raisin grapes, cherries, apricots, plums, and peaches.

The effect of the war was to disrupt the normal routes of flow of migratory workers in the Southwest. As the reports of the Tolan Committee on Interstate Migration established, the groups who engage in migratory farm work rarely do so from choice, but for lack of opportunity to secure continuous employment in one place. The increased employment opportunities of the war led many erstwhile migrants to settle down in defense centers and thus dried up a major source of seasonal farm labor. Another factor was the institution of gasoline and tire rationing, which tended to immobilize workers who had formerly been transported by truck and automobile. Sugar beet grow-

6. McWilliams, *Ill Fares the Land*, 231-32.

7. Warren R. Bailey to the author, April 3, 1951.

ers in the Mountain states asserted frequently during the war that their usual supplies of seasonal workers from South Texas were being deliberately withheld by the actions of local ration boards who had the power to refuse gasoline and tire allotments and who were influenced by the local desire for a plentiful labor supply. Whatever the merit of this assertion, the supply of labor, readily augmented from across the border, was markedly greater in the Lower Rio Grande Valley than in the Rolling Plains and the High Plains during the latter years of the war.

On the West Coast a similar disappearance of normal numbers of migrant workers occurred. At the petition of farmers throughout the western states, the United States thereupon entered into an agreement with the Mexican government in August, 1942, to permit the importation of Mexican nationals under contract as emergency farm workers. Having previously experienced the stranding of its citizens in the United States at the end of the work season with little income left in the hands of the migrants, the Mexican government stipulated minimum wage and employment conditions for the labor to be contracted. In addition it refused to supply its nationals to any state in which there was social discrimination in the use of community facilities, such as in the public schools. As a result Texas was excluded from the terms of the international agreement during the war-emergency period, and most of the Mexicans legally admitted went to California (although twenty-three other states, mostly in the western half of the country, received some workers). At the peak of the Mexican labor program in 1945 somewhat over 60,000 workers were admitted, of whom 63 per cent were employed in California.⁸

However, this was by no means the limit of the influx, since many Mexicans entered this country illegally in search of opportunities similar to those afforded their legally contracted compatriots. In recent years this has given rise to the so-called "wetback" problem—"wetback" being the common designation for an illegal entrant from Mexico who has presumably swum or waded the Rio Grande.

Many of the same forces which have operated to move population from southern farms to cities have in prosperous times in the United States served to draw Mexican immigrants across the thinly patrolled southern border. On the "push" side is the force of population growth

8. President's Commission on Migratory Labor, *Migratory Labor in American Agriculture* (Washington: Government Printing Office, 1951), 38-39.

in relation to resource development. Mexico, in common with many underdeveloped areas, has a high birth rate and a high death rate. While both rates are declining, the latter is falling more rapidly, and net survivals are therefore increasing. At the same time arable land is extremely limited, and industry has been slow to develop. Wages in the interior are very low, and the country has been beset with inflation. Recently there has been very rapid economic development of the Mexican side of the Rio Grande Valley, especially in the growing of cotton on irrigated land. The consequent demand for seasonal labor on the part of Mexican employers has encouraged northward migration, with the result that most of the Mexican border towns have doubled their population in the last decade. "It is to be expected," reports the President's Commission, "that many Mexican workers coming north with the anticipation of working in northern Mexico do not find employment there and ultimately spill over the border and become wetbacks."⁹

On the "pull" side, in addition to the generally higher level of living standards in the United States, the most important factors are the recent expansion of cotton and specialty crops in the irrigated areas, and the traditional reliance on Mexican labor for seasonal work. Local employers are said to believe that they have a "peculiar right to get Mexican workers," even if they must be secured illegally. In fact, there is evidence that some employers have preferred to deal with smugglers of illegal entrants, rather than with workers legally contracted for under the International Agreement, because the threat of deportation could be used to hold law-violating aliens at low wages and under unfavorable working conditions. Some employers have withheld from wages a "deposit" which is intended to insure that an apprehended "wetback" will return to the farm from which he was taken for deportation.

Estimates of the number of Mexican workers who have entered the United States illegally in the past decade are rather unreliable because of the clandestine nature of the traffic and the fact that many deported aliens recross the border soon after ejection. It is believed, however, that the numbers of illegal entrants, as well as the known numbers of legally contracted workers, grew rapidly during the latter war years and afterward. In 1947, when the status of some of the illegal aliens

9. *Ibid.*, 72.

was legalized by special arrangement with the government of Mexico, 55,000 were thus legalized in Texas alone. On the basis of apprehensions by immigration officials, the President's Commission estimated that in 1949 at least 400,000 of the entire American migratory labor force of one million were "wetbacks." In 1950 deportations and voluntary departures reached 565,000, and the actual number within the country is therefore assumed to have been much larger.¹⁰

THE EFFECT OF THE WAR ON FARM WAGE RATES

As will be apparent from the preceding discussion, the available statistics on farm population based on residence frequently have little meaning in evaluating the acuteness of the agricultural labor pinch, especially when applied to local areas and to a highly seasonal crop such as cotton. Because of the housing shortage and the tendency for cities to decentralize, many people who were employed in cities during the war lived in the country and their small acreages were counted as farms. On the other hand, a number of farm operators and a great many occasional farm workers lived in towns. Whether the latter group continued to remain available to cotton growers depended to a considerable degree on the alternative opportunities for less seasonal and more agreeable types of work in town, as well as on competitive wage differentials. In remoter areas of the Cotton Belt the principal alternative employment for unskilled workers provided by the war took the form of irregular work on military construction jobs, which might or might not overlap the cotton harvest. In many cases no comparable opportunities existed after the war.

It is therefore advisable to examine information on changes in wage rates as a partial indication of the degree to which farmers have actually experienced a shortage of hired workers. It is a commonplace observation that the complaint concerning a "labor shortage" heard in agricultural localities around harvest time is often more of an expression of heightened anxiety about crop losses at this time and of unwillingness to meet competitive wage rates than of an actual condition of labor unavailability. The degree of increase in farm wage rates tends to serve as a test of competitive demands actually operating in the labor market and of farmers' earnestness in bidding for the available supply.

10. *Ibid.*, 69-70.

This was particularly true during the war in view of the fact that no legal restraint was imposed on a rise in farm wage rates in most areas, as there was on nonfarm wages. Because of the wide disparity which existed at the outset between wages in agriculture and wages in war industries, and the consequent drain on the farm labor supply, the general level of farm wages was classified as substandard and transferred from the authority of the Wage Stabilization Board by an order of the Director of Economic Stabilization on November 30, 1942. The War Food Administrator was authorized to permit employers of agricultural labor to raise wages at their own option (up to \$2,400 per annum), unless it became necessary to impose specific wage ceilings.¹¹ Moreover, the order provided that "no employer shall decrease wages or salaries paid to agricultural labor below the highest salary rate or wage paid for such work between January 1, 1942, and September 15, 1942..." without approval of the War Food Administrator.¹²

Significance of Farm Wage Data

Since wage rates apply only to the *hired* farm labor force, caution must be observed in interpreting wage movements as an index of the acuteness of the general labor stringency on farms. Some farmers hire little labor for cash wages at all, and then only at the peak of the harvest season. Although as a group sharecroppers occupy about the same economic status as wage workers, they are ordinarily classified as farm operators and do not appear in the hired labor force except insofar as they are able to find employment for cash income in addition to their regular duties. (Many of them join the hired labor force at cotton picking time and are then paid on a piece-rate basis.) Indi-

11. The ceiling was later defined as equivalent to \$200 a month or 85 cents an hour (assuming an average work day of nine hours and a working month of twenty-six days). Even at this low maximum rate (relative to industrial wages) it became necessary to impose specific ceilings in only the following cotton growing areas, and in them only during the harvest season: six counties in California, beginning in October, 1943; six counties in Arizona, beginning in September, 1944; twenty-one counties in Arkansas, nineteen counties in Mississippi, and forty-eight counties in Texas, beginning in August or September, 1945. Ceilings remained in effect until November 9, 1946, when all wage controls were ended by executive order of the President. Arthur J. Holmaas, *Agricultural Wage Stabilization in World War II* (Washington: B.A.E. Agricultural Monograph No. 1, 1950).

12. *Report of the Secretary of Agriculture, 1943* (Washington: Government Printing Office, 1943), 117.

rectly, of course, a shortage of sharecropper labor would be reflected in the wage rates paid to hired labor.

No satisfactory census tabulation is available to distinguish farms on which hired labor is important, although they will in general be the larger farms, as ranked by size and by value of production. For American agriculture as a whole it has been estimated that half of the farmers use no hired labor, another third use it only sparingly, and the remaining one-sixth employ over 90 per cent of the hired labor.¹³ In the South the proportion of farmers using hired labor is approximately the same, but the averages obscure important intraregional differences in employment patterns. According to an analysis made for major type-of-farming regions in 1945, a much larger proportion of farmers in the Western Cotton Belt used some hired labor during the year than in the rest of the region.¹⁴ In the Delta (where 84 per cent of the farms listed as separate units were operated by sharecroppers), only 47 per cent of the farms used hired labor, as compared with 67 per cent of those in the Western Cotton Belt, and 49 per cent of those in the Eastern Belt. In terms of man-days of labor used, however, the hiring farms in the Delta employed more than twice as much labor per farm as those in the Western Cotton Belt, and more than three times as much as those in the Eastern Belt. In the Delta the average was 355 man-days of hired labor per hiring farm; in the Western Belt, 158 man-days; and in the Eastern Belt, 115 man-days.

Several factors accounted for the differences. Yields are substantially higher in the Delta than in other parts of the region, thus requiring more manpower per acre for harvesting. Single farms employing large amounts of labor in the Delta are usually plantation operators' units being worked primarily with wage-hands. In the western part of the region, in contrast, farms are more highly mechanized and farmers are able to have their cotton pulled, rather than picked, reducing the amount of labor required per acre.

Notwithstanding the widespread use of hired farm labor on southern farms, it is highly probable that an increase in farm wage rates

13. Glen T. Barton, "Farm Wage Rates and Labor Efficiency," *Agricultural Situation*, 31, No. 1 (January, 1947), 8. The figures are based on a sample enumeration conducted in 1945.

14. U.S. Bureau of Agricultural Economics, *Wages by Type of Farm and Type of Farm Work, United States and Major Type-of-Farming Regions, 1945* (Washington: B.A.E., July, 1947), 38-39.

signifies initially the demand of larger farms for labor. Not only do they employ more labor, but they tend to pay higher rates for workers of similar ability than do smaller farms, whenever the supply situation intensifies the competition for labor. Operators of large farms are able to make more efficient use of hired labor and thus are willing to bid higher for it.¹⁵ This has special significance for the process of mechanization, since it is generally the larger farms that may be expected to mechanize first. So long as the larger farms can bid labor away from the smaller farms, it is possible for some of the more conservative-minded operators to forestall the day when mechanization becomes inevitable.¹⁶

The Rise in Farm Wage Rates

Farm wage rates in the South nearly tripled from 1940 to 1945, and by 1948 were at least three and a half times what they had been before the war (Table 12).¹⁷ The trend was similar in the United States as a whole, but the annual rate of increase in the West South Central states exceeded the national average in every year of the war except 1945. The other southern divisions lagged in rate of increase during the first two years of the war, but by 1944 they were also exceeding the national average, and by 1948 they had surpassed the accumulated rate of increase since 1939. The year of greatest acceleration in wage rates for all divisions was 1943, following the year of greatest off-farm migration. Farm wages rose by over 30 per cent in each of the three southern divisions that year, and they had risen almost as much the year before.

Piece rates for picking cotton which prevailed during the war and postwar years reflected most acutely the demand for harvest labor which occurred during the peak seasons in the Cotton Belt. An inspection of the data by states indicates that there were significant variations in the degree of labor stringency by localities.

15. Louis J. Ducoff, "Do Larger Farms Pay Higher Wages?" *Agricultural Situation*, 28, No. 10 (October, 1944), 17-20.

16. The resistance of some plantation operators to mechanization can hardly be overestimated. See Harald A. Pederson and Arthur F. Raper, *The Cotton Plantation in Transition* (Mississippi Agricultural Experiment Station, Bulletin 508, State College, January, 1954), 4-6.

17. See discussion below concerning the reliability of the data on which these statements are based.

The average rate for picking one hundred pounds of seed cotton rose, for the entire Cotton Belt, from 62 cents in 1940 to \$1.93 in 1945 (an increase of 211 per cent).¹⁸ The rate continued to rise in the post-war period, reaching a peak of \$2.90 in 1948, an increase of 368 per cent from 1940. The sharpest rises in picking rates during the war

Table 12

INDEX NUMBERS AND PERCENTAGE CHANGE OF ANNUAL FARM WAGE RATES, UNITED STATES AND SOUTHERN DIVISIONS, 1939-1952 (1939=100)

Year	United States		South Atlantic		East S. Central		West S. Central	
	Index*	% change	Index*	% change	Index*	% change	Index*	% change
1939	100		100		100		100	
1940	102	1.6	102	2.2	103	2.5	102	1.7
1941	124	22.1	120	17.7	120	17.2	132	29.4
1942	161	30.0	151	25.9	155	28.7	175	33.1
1943	212	31.7	199	31.1	202	30.4	233	33.2
1944	254	19.7	241	21.2	250	23.8	291	24.9
1945	284	11.6	276	14.8	270	8.1	321	10.0
1946	309	9.0	317	14.7	304	12.8	342	6.7
1947	329	6.3	338	6.9	329	8.3	371	8.5
1948†	345	5.0	357	5.4	350	6.1	387	4.4
1949	333	-3.4	349	-2.2	329	-5.8	391	1.1
1950	335	0.5	351	0.6	335	1.8	389	-0.7
1951	373	11.4	396	12.8	381	13.5	433	11.4
1952	394	5.6	414	4.8	396	4.0	460	6.1

SOURCE: U.S.B.A.E., *Farm Labor*, December 11, 1950, 9-13; *ibid.*, January 12, 1951, 10-12; *Crops and Markets*, 29 (1952), 128; *ibid.*, 30 (1953), 125.

* Based on a composite of average monthly and daily rates; index converted from 1910-14 to 1939 base.

† Data collected on a revised basis beginning in 1948. Index numbers linked for approximate comparability.

took place in the eastern seaboard states and in Texas, which had been relatively low-wage states before the war and which were directly affected by industrial activity in the seaport cities. By 1948, a large crop year, the pinch was being felt most keenly in the Delta states of Arkansas and Mississippi, where the picking rate per hundred rose to

18. U.S. Bureau of Agricultural Economics, *Farm Labor*, November 10, 1950, 9; U.S. Agricultural Marketing Service, *Crops and Markets*, 30 (1953), 124.

400 and 470 per cent, respectively, above the 1940 average.¹⁹ This no doubt reflected the large scale departure of Negro farm labor from these areas, and the inability of employers to secure adequate replacements of Mexican labor from the Southwest.

Local variations in the adequacy of the labor supply within states were probably quite significant during the war, as, for example, between the High Plains of Texas and areas within the state nearer the Mexican border. The statistics on wage rates which would be necessary to establish these differences are not readily available.

The postwar increase in farm wages which we have noted is probably not as significant as the high wartime rates of increase because of the acceleration of general price inflation and of competitive industrial wage offerings following the relaxation of wartime price and wage controls. The effect of controls on nonfarm wages was to narrow the disparities between farm and nonfarm wage rates that had existed before the war, but when controls were lifted the old relationship was to some degree restored by the tendency of nonfarm wages to spurt upward relatively more rapidly.

Yet the fact that farm wages continued to remain at high levels in the years following the war, as compared to prewar rates and to the rise in other farm costs, meant that employers of farm labor could not regard the increase in labor costs as a temporary wartime phenomenon, but must regard it as a major change in cost relationships to be taken into account in planning their future operations. As noted above, this statement applies particularly to the employing sector—the “hiring farms,” whose scale of operation and value of output impel the use of hired labor—as distinguished from those farms employing mainly family labor or those able to preserve a sharecropper arrangement. Operators of small farms who need to hire only a few man-days at peak seasons are not seriously affected even by marked increases in wage rates unless labor becomes totally unavailable at a critical time.

The Preservation of State and Regional Differentials

An examination of both annual wage rates and the piece rates for cotton picking reveals that despite the large average increases in wages

19. The rate actually fell in these areas in 1945, despite the fact that the price of cotton continued to rise, because of the imposition of a federal wage ceiling of \$2.10 per hundredweight. See J. Lewis Henderson, “In the Cotton Delta,” *Survey Graphic*, XXXVI, No. 1 (January, 1947), 51.

which have been noted and some adjustments in rates in response to changing local conditions, the traditional differentials in wage payments by areas within the South were largely preserved. Among the southern geographic divisions, the East South Central states consistently show the lowest wage rates, and the West South Central states the highest. Among individual states, South Carolina has almost invariably afforded the lowest wage, followed closely in order by Georgia and Alabama; and this has remained true in the postwar years. For the entire cotton region, the higher wage states have been California, the border states of the South (including Oklahoma), and Florida; although it must be noted that cotton farming occupies a relatively small role in the economies of these states.

The most noteworthy change in the regional wage pattern, for the short period under examination, appears to have been the emergence of the Delta area, from the Boot Heel of Missouri to Northeastern Louisiana, as a relatively high-wage district, and this may have had special significance for the mechanization of cotton production, as it was in this district that some of the most active experiments with newer methods of agriculture were conducted.

Not only were customary wage differentials within the region preserved, but the South as a whole undisputedly remained the region of lowest farm wages in the country at the end of the war. The South Atlantic and West South Central divisions had narrowed the relative disparities somewhat, but in absolute terms the wage differentials were still strikingly large. This may be roughly indicated by a comparison by geographic divisions of the composite wage, converted to a monthly basis, upon which the Department of Agriculture based its index of farm wage rates until 1948. In 1945 the average monthly farm wage for the East South Central states stood at \$54; for the South Atlantic states at \$62; for the West South Central states at \$77; for the East North Central states at \$92; for the Middle Atlantic states at \$95; for the West North Central states at \$105; for the New England states at \$108; for the Mountain states at \$116; and for the Pacific states at \$156.²⁰ In 1939 the average wage paid in the highest (Pacific) division was 2.7 times that paid in the lowest (East South Central). By 1943 the ratio had risen to 3.2; but by 1945 it had fallen again to 2.9 and by 1948 to 2.4.

20. U.S. Bureau of Agricultural Economics, *Farm Labor*, December 11, 1950, 9-13.

The degree to which such wage differentials have enabled cotton farmers to meet their production problem by reliance on cheap labor is conspicuously brought out by the finding that although farmers in the Cotton Belt used nearly a third of the total hired labor employed on American farms in 1945, they paid only about a fifth of the country's annual cash farm wage bill.²¹

In view of the disproportionately heavy outflow of population from southern farms during the war, and in view of the fact that southern farm wages showed considerable upward flexibility at this time, how is the continuation of large regional differentials in wage rates to be accounted for? Studies by Louis J. Ducoff indicate that farm wage rates tend to move rather closely in relation to gross cash farm income per worker (with a lag of about six months representing the tendency of farmers to set their current wage payments on the basis of the past year's cash receipts).²² This suggests that farm income tends to set a limit on the extent to which farmers can bid for hired labor, and constitutes the most important explanation of the relatively low farm wage rates which have prevailed in the South at all times.

The relationship between farm income and wages is not a rigid one, however, and at least two other major factors must be considered in addition to ability to pay: (1) regional differences in the degree of surplus labor supply existing from time to time; and (2) regional differences in the competitive wage level in nonfarm occupations. These require separate comment:

1. As has already been explained, because of its demographic characteristics the South has had a chronic tendency to oversupply itself with farm labor, as compared with other regions. During the depression farm wages dropped more rapidly in relation to farm incomes in the South Atlantic and East South Central states than in the other divisions of the nation, and for this the disproportionate labor surplus in the South appears to have been mainly responsible.²³ Because of the lingering effect of an accumulated unemployed and underemployed

21. U.S. Bureau of Agricultural Economics, *Wages by Type of Farm and Type of Farm Work, United States and Major Type-of-Farming Regions, 1945*, 32.

22. Louis J. Ducoff, *Wages of Agricultural Labor in the United States*. U.S.D.A. Technical Bulletin 895 (Washington: Government Printing Office, July, 1945), 54-59. This report is based on an analysis of farm wage and income movements from 1910 to 1943.

23. Louis J. Ducoff, "Farm Wage Rates," *Agricultural Situation*, 27, No. 9 (September, 1943), 9-13.

labor reserve during this period, farm employers did not have to pay much higher wages, even though their own incomes improved, until well into the war. Any interruption in the normal outflow of farm population from year to year, such as occurred during the thirties and for a brief period after the end of the war, is likely to have a prolonged depressing effect on southern farm wages.

2. Regional differences in the competitive wage level in nonfarm occupations which would constitute alternative employment for farm workers are not easily tested because of the difficulty in finding an appropriate nonagricultural wage series for comparison. A comparison of average hourly earnings of workers in manufacturing industries with those of workers on farms is of questionable value since farm workers are ineligible for many of the factory jobs because of lack of skill, immobility and lack of information, racial discrimination, and similar reasons. Probably the most relevant wage series are those for unskilled nonagricultural labor, such as common labor for road building, and unskilled labor in agricultural processing and manufacturing industry. As Ducoff points out, "Farmers do not generally have to compete with all grades of wages in manufacturing industries. Although wartime demands for labor and the progress in simplification of industrial jobs have widened the range of occupations open to farm laborers, the industries that have always been important competitors (and still are) consist largely of a group which hires a high proportion of unskilled and semi-skilled workers."²⁴

Ducoff therefore constructed a composite series based on hourly entrance rates of common labor in twenty industries throughout the United States as of July, 1942. He found considerable regional variation in nonfarm wage rates which corresponded in general to the regional variation in farm wage rates. It is noteworthy that at this time, which was before farm wages showed their greatest rise, cash farm wage rates in eight southern states and Missouri were only 37 to 44 per cent of the entrance rates for common labor in industry, whereas in all other states they were at least 50 per cent and in some states a great deal higher. Ducoff attributed this difference in considerable degree to the exclusion of Negroes from many industrial jobs in the South, so that southern farmers had not felt local industrial competition so keenly for a major part of their labor supply.²⁵

24. Ducoff, *Wages of Agricultural Labor in the United States*, 76.

25. *Ibid.*, 72-79.

In the later years of the war the increasing mobility of the labor force and the effect of the wage stabilization program on nonagricultural wages combined for a time to reduce the disparities between farm and nonfarm wages which existed in 1942.²⁶ But the general pattern of marked regional variations in both farm and nonfarm wages persisted. Whether the present trend toward increasing industrial development in the South will significantly reduce the traditional regional differentials in industrial wage rates, and thereby exert a secular upward pull on southern farm wages, it is probably too early to tell.

Note on the Reliability of Farm Wage Data

In the above discussion it has been necessary to rely in large part upon farm wage-rate data about whose reliability there is some question.²⁷ The principal question arises out of the method by which the data have been secured. Under the Department of Agriculture's crop reporting system, a mail questionnaire is sent quarterly to a list of local volunteer crop reporters, who are asked to estimate "average wage rates being paid to hired labor at the present time in your locality." Because the group of farmers willing to cooperate with the survey varies with time and place, and because the reporters are asked for an estimate of prevailing wages rather than a statement of wages actually paid, it is uncertain to what degree the reported wage rates are representative of actual wage rates in the areas specified. There have also been troublesome problems of defining the value of board and other perquisites, and of converting monthly, daily, hourly, and piece rates to a common weighted composite which would be meaningful for interregional and intraregional comparisons. In 1948 a com-

26. In an unpublished memorandum on "Considerations Basic to the Development of an Agricultural Wage Stabilization Policy and Program," prepared for the U.S. Wage Stabilization Board on February 21, 1951, by Louis J. Ducoff, he reported that, "Cash farm wages had averaged 16.1 cents per hour during the prewar period of 1935-39—only 27 per cent of the average industrial wage in manufacturing of 59.8 cents during that period. After 1940 real farm wages began rising relative to real industrial wages until they reached a peak in 1945 and 1946 of 41 per cent. Since 1946, real farm wages have declined relative to real industrial wages and in 1950 were back to 33 per cent." The comparisons are national ones, based on average hourly earnings of hired farm laborers and production workers in industry in the United States, adjusted for changes in living costs within the respective groups.

27. See R. F. Hale and R. L. Gastineau, *Reliability and Adequacy of Farm Wage Rate Data* (Washington: U.S. Agricultural Marketing Service, February, 1940); and Ivan M. Lee, "A Critical Evaluation of Available Agricultural Statistics," *Journal of the American Statistical Association*, 47, No. 258 (June, 1952), 267-80.

prehensive revision of the basis of weighting the wage-rate index was undertaken, one result of which is that the index now reflects changes in an hourly composite wage rather than a monthly wage. While the current index numbers are linked with the pre-1948 series constructed on a 1910-14 base, there is serious question as to their comparability. Despite the limitations of the data, they are without doubt the most comprehensive and therefore the most useful available for the period under consideration.

In an attempt to improve the usefulness and reliability of farm wage data, the Bureau of Agricultural Economics conducted a valuable series of sample surveys of wages and wage rates in agriculture by special crop areas, geographic regions, and type-of-farming regions beginning in 1945 and continuing through 1948. Reference has been made to some of the reports emerging from these surveys and, wherever feasible, generalizations regarding wage characteristics based on the earlier data have been checked for consistency with the findings of the more intensive surveys.

CHAPTER 11

Changing Tenure Arrangements

FARM OPERATORS in the older Cotton Belt have in recent times shown unusual readiness to shift from a sharecrop to a hired labor basis in operating their farms, or the reverse, as the current season's advantage seemed to lie. For example, in the prewar years a great many operators changed from a sharecrop to a wage system to avoid sharing government parity payments with the croppers on their farms. Under war-time conditions, however, many employers reverted to the traditional method of holding their labor by again offering a share of the crop. It is therefore necessary to consider in connection with the farm wage and employment data already presented certain significant changes in tenure relationships which have been taking place.

Farmers throughout the United States made use of the increased incomes afforded by the war years to retire debt and improve their equities in farm land. The result was a pronounced increase in farm ownership and a corresponding decline in farm tenancy, revealed in Figure 7. The decline in tenancy included a drop from 1940 to 1945 of over 94,000 in the number of cropper-operated farms in the South. It is noteworthy, however, that the principal decline in tenancy was concentrated among classes other than sharecroppers. In North Carolina and South Carolina the number of croppers actually increased during the war (although this proved to be only a temporary reversal

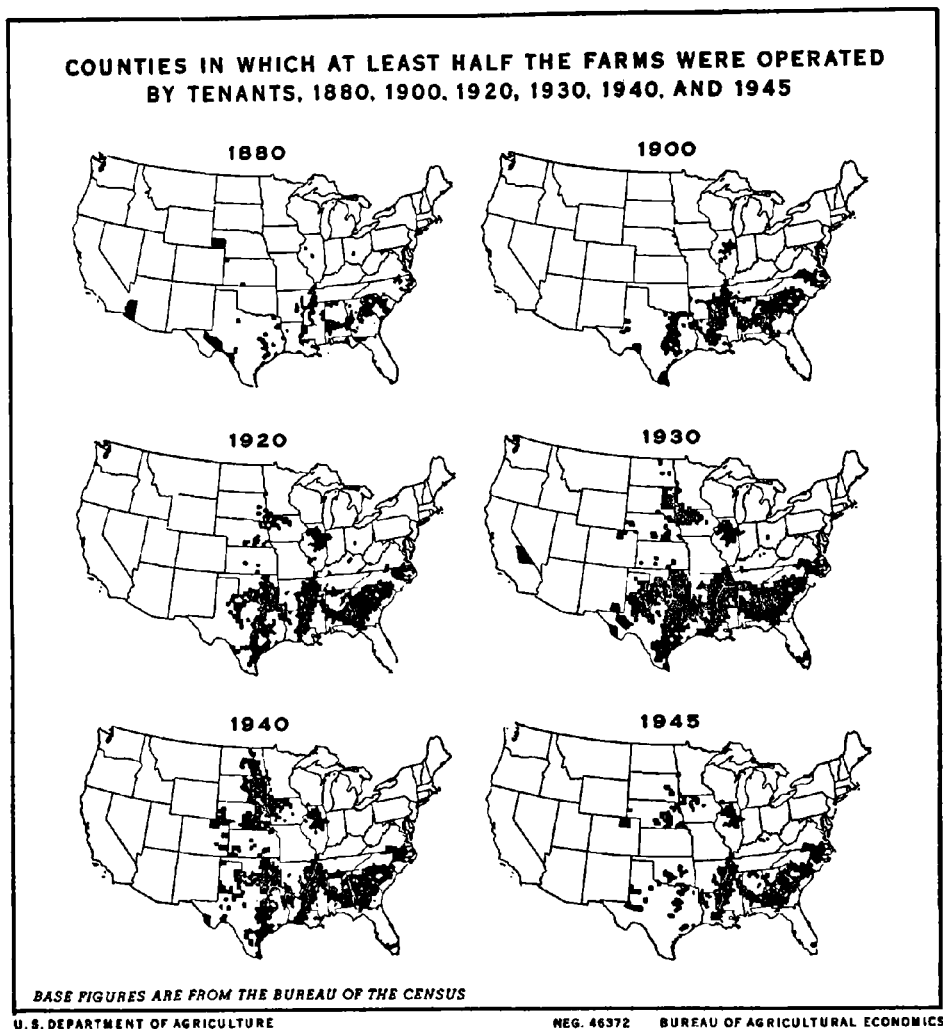


FIGURE 7

of the general trend).¹ What was the significance of the shifting and uneven changes in the basic tenure system during this period?

1. U.S. Bureau of the Census, *United States Census of Agriculture: 1945. Special Report, Farms and Farm Characteristics by Color and Tenure of Operator* (Washington: Government Printing Office, 1949), Table 1; U.S. Bureau of the Census, *U.S. Census of Agriculture: 1950. Vol. II, General Report, Statistics by Subjects* (Washington: Government Printing Office, 1952), Tables 22 and 25.

DIFFERENTIAL CHANGES IN SHARECROPPING
BY COLOR AND LOCALITY

During the decade from 1940 to 1950 there were marked local variations in tenure changes as between white and nonwhite sharecroppers in the various southern states. During the war years there was a net decrease for the South in both white and nonwhite croppers, but the rate of decrease was much greater among the whites, reflecting the greater opportunity for nonfarm employment for this group, and possibly the greater preference of farm owners for Negro workers. The number of white croppers declined, for the Census South, by 27.2 per cent, while nonwhite croppers declined by only 9.6 per cent.

Within the region the changes varied considerably by states and by local areas. Although every state showed a decline in the number of white croppers, five states showed an increase in nonwhite croppers by 1945. The increases were concentrated in the seaboard states of North Carolina, South Carolina, and Georgia, where farm owners were apparently most successful in using the offer of a sharecrop as a means of retaining their Negro labor. In a good many cases new and more liberal tenure arrangements were worked out, in which the cropper received a share of the livestock or other subsidiary enterprise as well as a share of the cotton crop. Similar offers were undoubtedly made in other areas, but with markedly less success. Mississippi alone lost 8,500 white and 20,000 Negro sharecroppers during the war years, followed by the loss of another 1,400 white and 21,000 Negro sharecroppers from 1945 to 1950. It is impossible to say how many of these croppers actually left farming, since some may have risen to higher tenure status, and others may have been reduced to a wage status but continued to work on farms.

An inspection by counties shows that the wartime decreases in nonwhite croppers occurred almost wholly in one contiguous area extending from central Alabama across Mississippi, Arkansas, and Louisiana into eastern Oklahoma and Texas, while the increases occurred in a similarly contiguous area of the upper coastal plains and parts of the Piedmont of the Carolinas and Georgia, where peanuts and tobacco as well as cotton are grown.² It is worth noting that the former areas are

2. U.S. Bureau of the Census and Bureau of Agricultural Economics, *Graphic Summary of Farm Tenure in the United States* (Washington: Government Printing Office, 1948), 18-19.

in general more productive cotton lands and are better adapted to mechanization than the latter; hence the heavy decline in the number of sharecroppers came in the areas where mechanization was most likely to offer a feasible alternative.

In the postwar years the decline in the number of sharecroppers continued at an accelerated rate, and asserted itself in every state. During this period the decline in the number of Negro sharecroppers tended to catch up with the previous decline in white sharecroppers, so that by the end of the decade the rate of decline for the former was nearly as large as for the latter. The decrease in cropper-operated farms in the Census South from 1940 to 1950 was 195,000, or 36 per cent of the cropper farms at the beginning of the period.

It should be observed that the decline in the proportion of tenant-operated farms, as well as the absolute increase in the number of owner-operated farms, which took place in the South during the decade of the forties does not uniformly signify a movement of farmers up the traditional tenure ladder. The decline in tenancy to an important degree resulted from the departure from farming of the least attached members of the farm labor force, especially white croppers and share tenants. The increase in the number of owner-operated farms, on the other hand, partly represents the growth in the number of small farm units, often operated as part-time farms near urban centers, and the parcellation of land which frequently takes place when ownership is transferred through inheritance. The average size of owner-operated farms in the South steadily declined from 1910 to 1940, although the trend seems to have been arrested during the most recent decade. At the same time the size of farms operated by tenants and part owners increased at accelerated rates during the decade 1935-1945 (Figure 8).³ The rapid growth in the size of farms operated by part owners, who own a part and rent from others the remaining part of the land they operate, is associated with the increased use of machinery which requires larger units for efficient utilization.

Companion studies of land ownership conducted since the war by the Southeast Regional Land Tenure Committee and the Southwestern Land Tenure Research Committee have confirmed and extended earlier information indicating that there has been a simultaneous increase both in large and in small land holdings at the expense of

3. *Ibid.*, 4.

medium-sized farms in recent decades. Some indication of the disparities of land-ownership concentration and parcellation is suggested by the finding that in the Southeast (defined for these studies as including Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia) in 1946 only 2.4 per cent of the total acreage

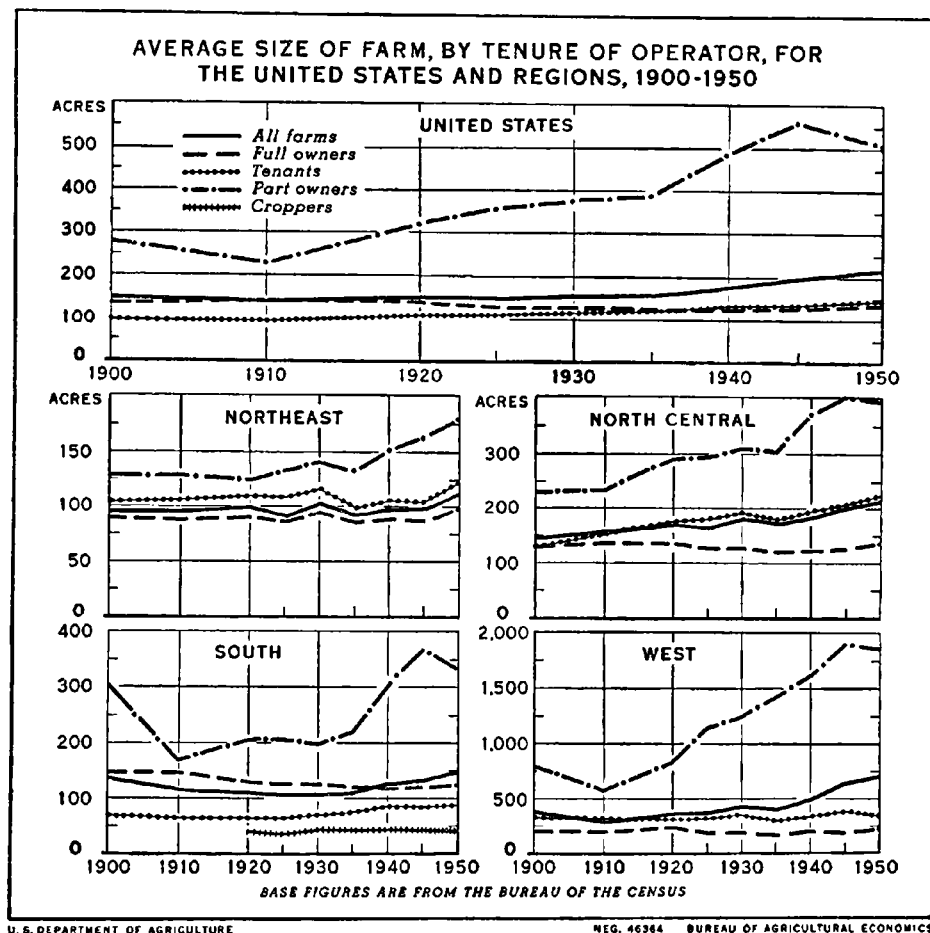


FIGURE 8

was held by owners whose units were under thirty acres in size; yet 25.5 per cent of all owners were included in this group. At the other extreme, 21.6 per cent of the land was in the hands of 1.1 per cent of the owners, each of whom held one thousand acres or more.⁴

4. Max M. Tharp, *Farm Land Ownership in the Southeast* (South Carolina Agricultural Experiment Station, Bulletin 378, Clemson, June, 1949), 13.

In the Southwest (defined as Arkansas, Louisiana, Mississippi, Oklahoma, and Texas) where units tend to be larger and the cattle ranches and wheat farms of Texas and Oklahoma as well as the river-bottom cotton plantations raise the averages for the larger farms, 31.4 per cent of all owners, representing those with holdings of less than seventy acres each, owned only 2.5 per cent of the total acreage. In contrast, 6.1 per cent of the owners—those with one thousand acres or more—owned 56.8 per cent of the land.⁵

The trend toward increasing disparities in farm land-holdings is often deplored as tending to destroy the institution of the moderate, "family-sized" farm which has long been idealized as the basis for prosperous, socially equalitarian farm community life. While it is probably true that this trend is associated with widening income disparities from farming, related to the size of the unit under control, two offsetting considerations should be borne in mind:

(1) The increase in small holdings near towns and cities does not necessarily represent the impoverishment of a small-holding class, but often reflects better opportunities for nonfarm employment as well as the utilization of rural housing facilities for urban workers in overcrowded areas. Residents on these "farms" are thus not actually dependent on them for income, but often rent the land out to relatives or others who combine small acreages into effective operating units. This is one of the ways of adjustment in which the rural population actually engaged in agriculture is effectively reduced while farming efficiency is improved.

(2) In light of the present size and complexity of equipment involved and the consequent investment required, the total mechanization of cotton production is unquestionably facilitated by operating units of relatively large size. This relationship has been demonstrated previously in other crop regions and recently within cotton itself, particularly in the western portions of the Cotton Belt including California. As an economic unit the "family-sized farm" therefore requires periodic redefinition which takes into account the technical requirements of increasingly mechanized farming. Such a development would not necessarily entail the establishment of "factory farms" of tremendous acreage, but would involve an adjustment of the size of

5. John H. Southern, *Ownership of Farm Land in the Southwest* (Arkansas Agricultural Experiment Station, Bulletin 502, Fayetteville, December, 1950), 23.

operating units to compatibility with the efficient utilization of diverse equipment under varying local conditions of terrain, soil type, and similar factors. In discussing this problem, Calvin B. Hoover and B. U. Ratchford remark,

The small size of farms is one of the greatest barriers to mechanization and one of the chief causes of low per capita income in the South. As one of the critics of these pages has commented: "It is the plantations with their croppers that can most easily be recast into the large-scale mechanized agriculture that offers efficiency in the economic sense. More small owner-operators make the change to large-scale operators more difficult."

Just because small owner-operators are more stable and because they have a financial interest in the land, they may make the shift to mechanization more difficult because they do not have the funds with which to buy mechanized equipment nor enough land to use it efficiently—even if they had the ability and the desire to use it, which they do not have in some cases. It is possible that there is here a conflict between the scale of production in agriculture which is economically most efficient and the scale of production which is socially more desirable. However, it should be noted that a substantial proportion of the advantages of mechanization and of the advantages of the balanced farm enterprise are attainable outside the plantation sized farm unit. Consequently it is by no means certain that a larger proportion of owner-operators would in fact result in an increase in the proportion of farms which could not utilize the advantages of mechanization.⁶

The preservation of the moderate-sized farm will no doubt be fostered by the development of techniques for the complete mechanization of cotton which employ smaller and more versatile mechanical units than the first machines introduced. Intensive research in this direction is now under way at several experiment stations, and implement manufacturers, seeing the prospect of a broader market, are increasingly turning their attention to the needs of the moderate- and small-sized farms. The increased use of large-scale equipment on a custom basis would also remove some of the pressure to expand the size of units as mechanization becomes more widespread.

6. Calvin B. Hoover and B. U. Ratchford, *Economic Resources and Policies of the South* (New York: The Macmillan Co., 1951), 109-10.

TRANSITIONAL TENURE ARRANGEMENTS ASSOCIATED
WITH PARTIAL MECHANIZATION

Some very interesting and significant changes in tenure arrangements which reflect the transitional stages of cotton mechanization have recently taken place in the South. Unfortunately the extent of these changes is not ascertainable from the Census reports and little descriptive material exists detailing the variety of arrangements which individual farm operators have devised as a means of easing the introduction of machinery. The following descriptions must therefore rest upon fragmentary evidence from scattered sources.

In the Mississippi Delta during the thirties a cropper-wage type of arrangement emerged under which a cropper family was given a small sharecrop, inadequate to provide sufficient income for the year, but sufficient to induce the family to remain located on a given farm and to see the crop through. For the remainder of its income the family was dependent on wage employment which the provider of the sharecrop could offer at his option. In an appreciable number of cases by 1940 the wage earnings formed over 50 per cent of the family income.⁷ This arrangement had the advantage for the employer that it provided stability of the labor supply while not obligating him to provide continuous full employment for the entire force, and thus it lent flexibility to his operations as mechanization was being introduced on an experimental basis.

As labor conditions became more stringent during the war, the sharecrop, sometimes as small as three acres of cotton, would be assigned to the wife of the sharecropper, who as the mother of small children was usually the most immobile member of the family. She would thus be induced to stay for the security provided by the sharecrop, with the expectation that the husband, who might leave for occasional defense jobs, would return from time to time to be near his family and thus be available for part-time farm work on a wage basis. The introduction of the tractor-drawn plow as a replacement for the walking plow made this arrangement more feasible than it would otherwise have been. According to Dr. Dorothy Dickins, who made

7. Frank J. Welch, *The Plantation Land Tenure System in Mississippi* (Mississippi Agricultural Experiment Station, Bulletin 385, State College, June, 1943), 49.

an investigation in 1947 of the effects of mechanizing cotton production on the labor force in the Delta,

Since the landlord has taken over the heavy farm work on many plantations, a family with an adult male worker is not as essential as it once was. Hoeing and picking cotton can be done quite satisfactorily by women and older children. It is interesting to note that the heads of 17 percent of the Negro families in this study were females; that 53 percent of the Negro labor supply were females.⁸

On some farms where partial mechanization has been introduced the sharecrop system has been retained, but the crop is worked "through-and-through," or "across-and-across," a method which has in fact long been customary on some plantations. Under this plan each cropper family is assigned a specific crop acreage, but instead of working this acreage in individual units, all workers on the plantation tend the common fields under a gang system directed by an overseer. This facilitates the use of tractors for ground breaking and seedbed preparation, followed in some instances by mechanical planting and cultivating.

A variety of arrangements has been worked out to compensate the operator for the increased input costs which formerly were part of the manual contribution of the cropper. Many planters have begun to charge their croppers service fees for the operations performed with power equipment, part of which are used to pay the wages of the tractor driver, who may also be a cropper himself. Others have shifted from the traditional 50-50 to a 60-40 share basis, under which the operator pays for all seed, fertilizer, and poison, and receives in return 60 per cent of the crops and 60 per cent of the government soil conservation and parity payments.

A third transitional arrangement, which might be combined with those already mentioned, has been to divide the plantation labor force into two parts: (1) a basic crew sufficient to insure weed control in ordinary seasons, which forms about one-third to one-half the total number employed, and which is stabilized on the farm by being assured a sharecrop; and (2) the remainder of the employees, who are on a wage basis and whose employment fluctuates with the demands of the

8. Dorothy Dickens, *The Labor Supply and Mechanized Cotton Production* (Mississippi Agricultural Experiment Station, Bulletin 463, State College, June, 1949), 10.

season and the year.⁹ The members of the latter group have little job security and are of course most readily detached as mechanization reduces the need for hand labor or as alternative opportunities pull them away from the farm.

An example of the effect of these transitional tenure arrangements, combined with the increased opportunities for nonfarm employment, is provided by case studies of two plantations in Bolivar County, Mississippi, one of which is in an advanced stage of mechanization, and the other of which is still relatively unmechanized.¹⁰ Table 13 shows the

Table 13

NUMBER AND OCCUPANCY OF TENANT HOUSES ON TWO BOLIVAR COUNTY, MISSISSIPPI, PLANTATIONS, SELECTED DATES, 1905-1951

Year	"Mule Plantation" (Slightly mechanized in 1951)				"Tractor Plantation" (Almost completely mechanized in 1951)			
	Number of tenant houses			% change in occupied houses	Number of tenant houses			% change in occupied houses
	Total	Vacant	Occupied		Total	Vacant	Occupied	
1905	92	2	90	—	117*	0	117	—
1920	91	2	89	-1.1	136	0	136	16.2
1930	90	3	87	-2.2	133	0	133	-2.2
1940	84	24	60	-31.0	114	0	114	-14.3
1951	74	18	56	-6.7	107	17	90	-21.1

SOURCE: Harald A. Pederson and Arthur F. Raper, *The Cotton Plantation in Transition* (Mississippi Agricultural Experiment Station, Bulletin 508, State College, January, 1954), 9-11.

* This plantation was later increased in size, but it was not possible to secure information about housing for the added acreage.

changes in the number and occupancy of tenant houses on these plantations since 1905. "Mule Plantation," on which tractors are used only to a limited degree in preparing and cultivating the land, is operated almost entirely with sharecroppers who handle the crop in the traditional way with mule power and hand labor. Each cropper family has

9. Grady B. Crowe, "Economics of Cotton Mechanization, with Particular Reference to the Yazoo-Mississippi Delta" (Ph.D. dissertation, University of Virginia, 1950), 134-35.

10. Harald A. Pederson and Arthur F. Raper, *The Cotton Plantation in Transition* (Mississippi Agricultural Experiment Station, Bulletin 508, State College, January, 1954). The names used to designate the plantations are fictitious in order to preserve the anonymity of the cooperating owners.

its own tract averaging fifteen acres of cotton. From 1905 until 1930 the plantation maintained about ninety houses, usually fully occupied. During the thirties some of the tenants were let go because of crop reduction; later others left voluntarily to seek work elsewhere. Houses which burned or deteriorated from lack of use were not replaced, and by 1951 only seventy-four were left standing. Of these nearly one-fourth were vacant. No new houses have been built since 1920, and there has been no attempt to relocate the existing houses in the interest of improving the farm plan.

"Tractor Plantation," which in 1930 had 133 houses, all filled, underwent a major reorganization during the late thirties, involving the introduction of power equipment, replanning the farm layout, and pulling down 19 unoccupied houses. By 1951 it was almost as fully mechanized as was then feasible. Of the 107 houses left standing on this plantation, only 90 were occupied, and of these only 29 contained full-time cropper families. There were in addition thirty-seven cropper-wage families, each with a sharecrop of about three acres. Altogether these families handled only about one-third of the plantation's cotton acreage on a sharecrop basis. The remainder was worked on a wage basis by day labor, most of it resident on the farm. Only two of the sharecrops on the plantation were worked individually; the rest were worked "through-and-through" by machine, together with the operator's own two-thirds of the cotton acreage. In recent years about 70 per cent of the cotton crop on Tractor Plantation has been harvested with machines. Sharecropping on this farm has little meaning except as a preferred basis of hiring affording relative security to the most valued employees.¹¹

The respective orientations of these two enterprises is revealed by the following comment:

On Mule Plantation the assumption seems to be that though machines may take over eventually, men and mules will still be an important element in cotton production tomorrow. There are too many partly solved and unsolved links in the process for mechanized cotton production to be an immediate and real alternative. On Tractor Plantation the assumption is that machines—planters, flame cultivators, chemicals, mechanical pickers—

11. In a study made in the Delta in 1941 members of the plantation labor force expressed a decided preference for work on a share basis rather than for wages, largely because of greater assured incomes and perquisites. Welch, *The Plantation Land Tenure System*, 48.

will do the work tomorrow, but for the present much hand labor will be needed. Effective chemical and mechanical control of weeds and grass is possible even under field conditions in "normal" years. Next year may not be normal; therefore, hand laborers must be retained and hence employed even in normal years.¹²

A more striking, though probably exceptional, case is that of the Delta and Pine Land Company, a 38,000-acre operation. According to Oscar Johnston, manager of the plantation at the time of writing, its tenant population from 1935 to 1944 comprised about 850 families, but by 1947 the number had dwindled to 525, representing a permanent departure of over 300 tenant families from this plantation alone.¹³ It was Johnston's opinion, as we have noted, that the recent decline in tenant numbers did not represent displacement by the machine, but a response to outside opportunities. It must be observed, however, that the Mississippi-Yazoo Delta was one of the first areas to experiment extensively with the use of the mechanical cotton picker, and that farm workers in this area have been aware that it was only a matter of time until machines would be perfected which could perform much of their work. This consciousness may have served as one of the spurs to seek a departure from farming while conditions for nonfarm employment were favorable.

Changes in Other Parts of the Region

In other parts of the Cotton Belt it is more difficult to secure descriptions of significant transitional changes in tenure arrangements, partly because the process of mechanization has not been carried so far. One rural sociologist has estimated that on the coastal plain of South Carolina in the 1950 harvest season there were from seventy-five to one hundred plantation operators with mechanical cotton pickers, each representing an investment of over \$8,000, standing idle in their sheds while their cotton was being picked by sharecroppers and other resident hand workers. These unused machines were purchased as stand-by equipment in case of a labor shortage, and the interest and depreciation costs were charged off as insurance against a recurrence

12. Pederson and Raper, *The Cotton Plantation in Transition*, 8.

13. Oscar Johnston, "Will the Machine Ruin the South?" *Saturday Evening Post*, 219, No. 48 (May 31, 1947), 37, 94. For a description of this remarkable enterprise as it operated before the war, see "Biggest Cotton Plantation," *Fortune*, XV, No. 3 (March, 1937), 125-32, 156-60.

of difficulties experienced during the war, when some plantation labor left for construction jobs just as the cotton crop was being made. At that time the farm workers had little interest in the crop because of relatively low wages and cotton prices, and the planters had no alternative way of getting their crop picked.

Given both available machines and a plentiful supply of labor, as in 1950, planters prefer to have their cotton picked by hand, since it is then cleaner and higher in grade. Manual workers are also somewhat more versatile than machines, particularly under muddy conditions. More importantly, hand labor is still needed for weed control during the cultivation period, and if displaced during the harvest, it will tend to disappear from the community. The machines can stand idle from year to year, but the labor supply must be used while it is available. Since alternative opportunities are limited in this part of the country, farm workers must accept low wages, especially if the machine stands in sight as a potential competitor.

Another factor in the preference of planters for hand labor over machines is the genuine concern some of them feel for loyal employees of long standing who remained on the farm during the difficult war years and who are now too aged or untrained to find adequate employment elsewhere. Some of the larger operators, of whom a few have as many as one hundred cropper families, are introducing fuller mechanization only on that land from which the tenants have departed, which may be only a tenth of the cotton acreage. They reorganize the plantation by stages, pulling the empty houses down where necessary, and begin a new system of farming. At the same time traditional methods are continued for the most part on the cropper-operated portions of the plantation.

There is so far little evidence reported in the Southeast of changes in the traditional terms of tenure.¹⁴ Occasionally a landlord will make some slight alteration in the terms of agreement with new tenants, which suggests a desire to break away from the firm customary understanding of what is meant by being "on the halfers." When the question arises as to who pays for having the land broken by tractor in the spring, usage varies. Sometimes the landlord charges the cost

14. See Charles B. Ratchford, "Rental Arrangements in a Developing Economy" (Ph.D. dissertation, Duke University, 1951), 317-18. This study is confined to the Coastal Plain area of North Carolina, where cotton is rarely the main enterprise, but where some cotton is grown on general and tobacco farms.

to the croppers and sometimes he just "throws it in," because he has the tractor available for other work. New costs which come up, such as payment for additional fertilizer and insecticides, are usually shared by special agreement.

In the upland plains areas of the Southwest, where the process of mechanization of cotton production was already under way during the late thirties, the war merely accelerated trends which were already visible, and there were few distinctive changes in tenure arrangements. A study by Robert T. McMillan based on Census data for Oklahoma counties from 1920 to 1945 grouped these counties according to relative degree of mechanization in 1945 and correlated this grouping with other information available from the Census.¹⁵ According to this study, in which unfortunately no separate analysis was made to distinguish the changes during the war years, mechanization has been most advanced in the north central and western, or Low Plains, portion of the state, where wheat and grain sorghum as well as cotton are grown. Mechanization has been associated with a decline in farm population, a decrease in the number of farms, and an increase in the average size of farm. Over the twenty-year period from 1925 to 1945 there was a net loss of from three to four rural-farm persons for each increase of one farm tractor in the more highly mechanized counties.¹⁶ However, the rate of loss of population from counties with the least degree of mechanization, principally the hilly subsistence areas of Southeast Oklahoma, was nearly as large as in the most mechanized areas. This indicates that other factors encouraging emigration, such as lack of economic opportunity on poor land, were at work during the period.

Share tenancy, the most prevalent type of landlord-tenant leasing arrangement in Oklahoma, remained relatively high by 1945 in the mechanized areas, while having decreased substantially in the remaining areas. This suggests that mechanization in this type of farming requires units so large and possibly such a heavy investment in equipment that the necessary land is more easily acquired by leasing or part ownership than by full ownership, while the available liquid capital is expended on machinery.

In the adjoining High Plains of Texas farming conditions are similar, and it was in this area that the mechanical cotton stripper was intro-

15. Robert T. McMillan, *Social Aspects of Farm Mechanization in Oklahoma* (Oklahoma Agricultural Experiment Station, Bulletin B-339, Stillwater, November, 1949).

16. *Ibid.*, 7-9.

duced rather rapidly during the late war years to offset the shortage of casual migratory labor on which farmers had previously depended. Interestingly enough it was the smaller farmers who showed the most interest in mechanical harvesting and who initially got the most benefit from it. It is estimated that only about 30,000 to 35,000 workers migrated into the High Plains area during the 1944 harvesting season, as compared with about 50,000 such workers employed in the area in 1942.¹⁷ These workers assembled into larger crews than usual in order to obtain transportation into the area more readily and to enhance their bargaining position. As a result, the laborers were attracted to the larger farms, and farmers with 150 acres or less of cotton, who were at a disadvantage in bidding for labor, were compelled to seek other means to harvest their crops. A late frost that prevented normal hand-snapping and stormy weather that caused many workers to leave the area early contributed to the interest in using tractor-mounted strippers or sleds, some of which were fabricated in local blacksmith shops during the same season. There were in addition 230 factory-built strippers available for use in the area, whereas the year before there had been only a few machines, used principally for demonstration purposes. Small farmers harvested the greater portion of their crop with machine strippers, thus making it possible for them to maintain their cotton acreage. The machines were generally owned jointly by two or more operators, or were hired for use on a custom basis.¹⁸

During the following two years complaints of labor shortages in the High Plains, especially on dry land farms, were recurrent, and cotton growing was drastically curtailed in favor of raising grain sorghum. This crop had been completely mechanized as the result of the development early in the war of a variety that could be combined, and as both cotton and grain sorghum were well adapted to the area, farmers turned to the crop with the lower labor requirement. By 1946, however, the prices of feed grains were outrun by the price of cotton, the labor supply offered prospects of improvement, and irrigation farming was expanded by tripling the number of wells in the area. As a consequence, cotton acreage was once more expanded. The labor situation nevertheless continued to prove troublesome, and machine

17. Troy Mullins, *Harvesting Cotton in the High Plains Area of Texas: Machine vs. Hand* (Texas Agricultural Experiment Station, Progress Report 952, College Station, August, 1945), 6.

18. *Ibid.*, 30-31.

stripping became more common. A report on growing conditions in 1948, for example, contained the following statement:

Labor was scarce in the area at the beginning of the harvest season, except for irrigated cotton. Harvest labor was never abundant during any part of the harvesting season. Because of the drouth prevailing during a large part of the growing season, it was difficult for dry-land farmers in many sections to obtain harvest labor. Although premiums were offered, hands could make more money snapping irrigated cotton. For this reason, many dry-land cotton growers resorted to stripper harvesting. As bolls opened early on dry-land cotton and foliage was light, many stripper owners began harvest almost immediately after frost instead of waiting the usual ten days for the leaves to fall.¹⁹

In the critical crop year of 1944 it was estimated by local ginners that 18 to 20 per cent of the 500,000 bale crop was harvested with a rather limited number of sleds and tractor-mounted strippers.²⁰ By 1948 there were an estimated 4,000 to 4,500 machines of the stripper type (excluding sleds) available for use in the area. Of approximately 673,000 bales produced in the area that year, about 15 to 20 per cent were harvested by machine strippers.²¹ The following year, which was a record crop year, there were between 5,500 and 6,000 mechanical strippers available, and the proportion of the crop harvested by machine jumped to 40 per cent, or about 575,000 bales.²²

As has been pointed out by John D. Campbell, one of the most significant aspects of the mechanical stripper is that it may enable the small and moderate-sized cotton farm to survive as an efficient farming unit which utilizes the resident labor supply more effectively. It does this, in the area to which it is adapted, by freeing the farm family from its former dependence on outside labor to harvest the cotton crop. A single family can now harvest as much cotton as it can raise.²³

19. M. N. Williamson, Jr., and Ralph H. Rogers, *Economics of Cotton Harvesting, Texas High Plains, 1948 Season* (Texas Agricultural Experiment Station, Progress Report 1200, College Station, December 4, 1949), 2.

20. Mullins, *Harvesting Cotton in the High Plains Area of Texas*, 7.

21. Williamson and Rogers, *Economics of Cotton Harvesting*, 2.

22. M. N. Williamson, Jr., Q. M. Morgan, and Ralph H. Rogers, *Economics of Mechanical Cotton Harvesting in the High Plains Cotton Area of Texas* (Texas Agricultural Experiment Station, Bulletin 735, College Station, June, 1951), 11.

23. John D. Campbell, *Economic Aspects of Machine Harvesting Cotton in Oklahoma: The Present Costs and Future Prospects* (Oklahoma Agricultural Experiment Station, Bulletin B-364, Stillwater, April, 1951), 14.

Even though a farmer may not wish to strip his entire crop, he has the assurance that he can save most of the crop in the event of an extreme labor shortage.

A similar possibility for the preservation of the smaller farm through resort to mechanization appears to exist in California. According to Warren R. Bailey, who has made a close study of the conditions in the San Joaquin Valley,

Professional economists have often said that mechanization would drive the small farms out of existence. This prediction certainly has not come true, though census average farms have become larger. A modifying factor has been the development of smaller scale tractors and machines. I do not look for any material effect of mechanization on the size of cotton farms. Although a grower will need 150 to 200 acres of cotton to efficiently own a machine cotton picker, the smaller growers will employ custom harvesters. And the family-sized farm enjoys some offsetting elements of efficiency not open to the larger farms.²⁴

These adjustments would, of course, have some effect on the job opportunities for migratory workers, who were once more becoming available in considerable numbers, mainly in the persons of illegal immigrants from Mexico, by the beginning of the current decade.

EVALUATION OF THE WARTIME AND POSTWAR LABOR SITUATIONS

The foregoing discussion illustrates the complexity of supplying adequate, statistically grounded answers to the questions, "How acute was the wartime labor stringency in the Cotton Belt?" and "To what extent has the postwar era revealed a significant redistribution of manpower relative to land resources in the cotton economy?" The answers to these questions appear to be crucial to an analysis of the factors affecting the rate of introduction of labor-saving machinery into the Cotton Belt, and yet, with the information at hand, they elude precise quantitative determination. Therefore we must be content with an evaluative judgment which can only roughly weigh the influences affecting the cotton labor supply.

24. Warren R. Bailey to the author, April 3, 1951.

Summary of Findings

To summarize the findings of this and the preceding chapters, we may list the following general conclusions:

(1) There was a substantial decline in southern farm population due to migration during the war, temporarily interrupted in the immediate postwar adjustment period, and since resumed. Movement of Negroes was prominent in this decline, although it was spotty and delayed in getting started.

(2) Partially offsetting the swollen streams of migration from farms to the cities and out of the region were the continuation of characteristically high rates of natural increase and, in the western portions of the Cotton Belt, an increased influx of unskilled labor from Mexico.

(3) Farm employment figures, whose limited usefulness must be emphasized, indicate less of a labor drain from southern farms during the decade than the decline in farm population and the maintenance of high levels of urban employment would suggest. There has, however, been a marked decrease in the number of sharecroppers, both white and Negro, in the more productive cotton areas.

(4) The response of farm wage rates, which rose much more rapidly than wage rates in competing nonfarm employment, and the return to the offer of a sharecrop, which was particularly noticeable in the low-wage area of the Southeast, indicate that hiring farmers felt the labor stringency acutely enough during and after the war to raise materially their inducements to labor to remain available for work on the farm. Substantially increased farm incomes made possible the offer of these inducements.

(5) Nevertheless, the persistence of intraregional and interregional farm wage differentials, which were only slightly narrowed during the war, and the preservation of wide differences between farm and nonfarm wage rates despite the existence of wartime ceilings on the latter, suggest that most farm employers in the South, and especially in the Southeast, did not feel a competitive demand for essential labor so acute as to establish a new wage position for southern farm labor relative to labor in other farming regions and off the farm.

(6) The reconciliation of the relatively slight wage and employment effects, for southern agriculture as a whole, with the rather large departure of potential farm workers from the cotton areas can be made only by recognizing the enormous amount of slack which existed in

the cotton economy before the war in the form of unemployed and underemployed workers using relatively inefficient farming methods. The availability of less labor-intensive alternative farm enterprises also tended to relieve the severity of the farm labor problem.

(7) Thus only in a few areas does it appear probable that the mechanization of cotton production has been a direct response to a condition of actual labor unavailability in relation to customary cropping methods. The wartime introduction of cotton strippers into the High Plains and the more recent conversions to mechanical picking in the Mississippi Delta and in California may represent such cases, but for most other areas in the Cotton Belt total mechanization will have to push its way in against relatively abundant manpower resources. This situation, although by no means as severe as it was during the thirties, nevertheless threatens to widen the disparities in production methods within the region and to preserve continual pressure to leave the farms on appreciable portions of the rural population.

(8) Mechanization, as an alternative to traditional methods, will continue to exert this pressure because it is potentially so *highly* labor-saving, particularly when both the harvesting and the weed control problems have been firmly solved. There is, in a sense, a sonic barrier which the process of total mechanization must penetrate; once this barrier is pierced, the entire character of cotton farming changes and there is no longer any reason to hold large quantities of underemployed resident labor on the farms.

NON-ECONOMIC FACTORS AFFECTING MECHANIZATION

Notwithstanding the above conclusions about the objective conditions, it is possible that the recent rise in wage rates and the repeated anticipation from year to year of labor difficulty has generated in the minds of a good many southern farmers a psychological "labor shortage" which has tended to make them more machinery-minded. Power equipment affords a certain amount of personal convenience, and there is the prestige of becoming a "progressive farmer" attached even to partial mechanization. As the agricultural historian, Gilbert C. Fite, has remarked,

It is interesting and perhaps significant to note that the first impetus to use tractors on Southern farms did not come from the belief that production costs would be lowered. Replies received by Department of Agricul-

ture representatives in the early twenties from about 400 farmers indicated that less than 5 percent of those using tractors believed reduction in expense was important. In fact, many list the cost of operation as the chief disadvantage.²⁵

This recognition that farm operators are not always motivated by the strictly economic ideal of profit maximization is confirmed in an interesting way by findings contained in Charles B. Ratchford's intensive study of the effect of mechanization on rental arrangements in the Coastal Plain area of North Carolina.²⁶ Ratchford reached the unexpected conclusion that adding a tractor to multiple unit (cropper-operated) farms in this area did not tend to increase the average size of the farm unit, nor to reduce the number of croppers required on each plantation, but usually caused the party furnishing the tractor to receive a smaller share of the net return than before the tractor was added. In most cases it was the operator who furnished the tractor, but occasionally an exceptionally prosperous cropper had bought his own.

The area in which this study was conducted is largely devoted to tobacco and general farming. The units assigned to each cropper are small, being governed by the acreage of tobacco which a single family can handle. Units of from fifteen to thirty-five acres, on which three to five acres of tobacco are grown as the principal cash crop, are characteristic. On such farms tractors do not appreciably reduce the manpower required at the peak season, and since there is little possibility that the tobacco harvest will be mechanized in the near future, the introduction of tractors cannot be regarded as part of a transition to imminent total mechanization. As tractors have been added, the chief advantage has gone to the sharecropper, whose labor in those farm operations which could be mechanized has been correspondingly reduced. Under the conventional half share contract the landlord has generally absorbed the additional cost of purchasing and operating the tractor, although in some cases a part of the cost has been passed on to the cropper in the form of service charges. For such farms as a group, the addition of a tractor has usually resulted in a lower net income per cropper unit to the operator. The question naturally suggested itself,

25. Gilbert C. Fite, "Recent Progress in the Mechanization of Cotton Production in the United States," *Agricultural History*, 24, No. 1 (January, 1950), 22. The report cited is H. R. Tolley and L. M. Church, *Tractors on Southern Farms* (Washington: U.S.D.A., Farmers' Bulletin 1278, 1922), 5.

26. Ratchford, "Rental Arrangements in a Developing Economy," 290-91, 317-19.

why did the operators add tractors, particularly when they realized that their net income would thereby be lowered (as a number did)?

Several reasons were given, among which field men conducting the survey concluded that "keeping up with the Joneses," or maintaining a reputation for using progressive methods, even though at an economic loss, was among the most important. In some cases the tractor was added to increase the bargaining power of the operator in securing desirable croppers, especially during the war when there was considerable competition for tenants and the labor-saving aspect of partial mechanization could be used as an inducement to secure a more capable type of cropper. (According to Ratchford, the data do not indicate that operators providing tractors actually secured higher quality croppers, since croppers using tractors were not found to be farming larger acreages of crops or achieving a higher yield than croppers not using tractors.) In such cases the operator did not believe that he could charge the full additional cost of tractor services to the croppers.

For some operators the addition of a tractor could be regarded as *potentially* profitable, since in some seasons timeliness in planting is greatly aided by power equipment, and since a few operators planned to expand their farming to a degree which would justify tractor use on certain operations.

On the whole, however, the inference may be drawn that when operators' cash incomes are relatively high, as they were during and after the war, they frequently buy tractors, not on the basis of a careful analysis of expected cost savings, but out of a desire to "modernize" and to enjoy personal convenience, with the vague hope that costs will thereby be lowered and that uncertainty about the labor supply will be relieved. In most cotton areas, as in tobacco, the tractor does not yet in fact relieve the most acute bottlenecks in the production process—labor for chopping and labor for picking—but it is a symbol of mechanization which promises to ease these seasonal pinches when complementary equipment adapted to wide-scale use is introduced.

For the war and postwar period as a whole the net reduction in southern farm population undoubtedly brought about a more favorable adjustment of manpower to land resources, and by eliminating much of the slack it obliged cotton farmers to pay more attention to efficiency in the use of resources. The large wartime departure of people from the farms, even if the acute problems which it raised were only temporary, nevertheless had an important *permissive* effect in allowing long-

needed changes to be undertaken. In this sense the population shifts facilitated the experimental adoption of new methods in some areas even though over a somewhat longer period the labor situation would not necessarily have forced farmers to change long-term habits of operation. This to some degree accounts for the unevenness of the progress of mechanization and alternative land-use adjustments in the South.

The Irreversibility of Adjustments

It is important to note in this connection that many of the adjustments which have taken place in response to the population movements of the last decade are unlikely to be reversed. Where alternative enterprises involving a considerable investment, such as certain types of livestock raising, have been adopted, or where total or even partial mechanization has been introduced, demanding farm replanning and the destruction of tenant houses as well as investment in new equipment, it seems unlikely that even a considerable economic depression would lead to a return to older, more labor-intensive practices in these areas. Extended experience in other industries and other farming regions indicates that though the machine may be long delayed, once it comes it seems to dominate the future development of the enterprise which employs it.

Notwithstanding these indications of economic progress, it is well to remember that for important areas of the South there remains an excess of population relative to the present capacity of the land resources to afford a standard of living comparable to that in other rural areas. Whether this condition will continue to improve is heavily dependent on whether nonagricultural pursuits can continue to siphon off the redundant population resulting from the highest natural replacement rates in the country.

CHAPTER 12

A Look to the Future

THIS STUDY HAS sought to answer two questions: (1) In light of the early history of vigorous growth of the cotton enterprise and the history of mechanization of other major crops, why was technological advance in cotton production so long delayed? (2) Why has there recently occurred a marked acceleration in the process of technological change within the enterprise? The findings in answer to these questions will be summarized in the following discussion. In addition this chapter will consider briefly some of the economic and social implications of a continuation of the trends now visible in the cotton economy.

WHY TECHNOLOGICAL ADVANCE IN COTTON PRODUCTION WAS SO LONG DELAYED

The reasons for the tardiness of cotton mechanization may be grouped analytically under three headings: (1) institutional factors, (2) technological factors, and (3) factors originating outside the cotton economy.

Institutional Factors

A review of the history of cotton growing in the United States since the introduction of the upland variety shows the long-term growth of

institutional forces which came to have a powerful effect on the cotton enterprise as well as on the character of economic development of the entire region.

Commercialized specialization.—Upland cotton was introduced into an economy already accustomed to the colonial system of specialized production under conditions of commercialism. Existing credit institutions relying almost exclusively upon the use of the crop lien were preserved and extended as the cotton culture expanded westward. These institutions contributed to the establishment of a one-crop economy in the South. Organized as it was, the commercial system also fostered a destructive exploitation of the basic land resource which left the older areas at an economic disadvantage in comparison with the newer areas.

Institutions of control stemming from a slave economy.—The system of slavery left an institutional residue of measures to control and exploit an abundant labor supply which included the sharecrop system, systematic indebtedness of tenants, and racial discrimination in education and alternative employment. This set of institutions involved a presumption that cotton could be nothing other than a highly labor-intensive crop. At the same time, the existence of a large body of unversatile labor discouraged alternative lines of economic development for the region, such as shifts from the one-crop system, immigration and consequent diversification of farming, or industrialization.

Demographic characteristics of an underdeveloped economy.—The rural Southeast has tended to preserve longer than other portions of the country the population characteristics associated with preindustrial societies that have been in contact with more developed areas. That is, both birth and death rates are relatively high, and although both are declining, the death rate tends to fall more rapidly than the birth rate, resulting in a high rate of natural increase. The greatest increases have tended to occur among the group supplying most of the labor for cotton growing: rural Negroes in the southeastern states. The lack of alternative economic opportunities has contributed to a chronic oversupply of labor for the cultivation of the crop.

The role of government.—Governmental measures directly affecting cotton production have been important only during the past quarter century. While the policies put into operation have not been consistently directed toward any distinguishable long-term goals, they have had the general effect of aiding in the preservation of existing

institutional arrangements. When major modifications in farmers' conventional practices have been attempted, as in the cases of soil conservation and restrictions on output, these attempts have been carried on largely within the prevailing framework of institutions. In other cases, such as the land use planning program, the effort to effect major changes was not adequately supported and was unsuccessful. Nor can it be said that public agencies, with the exception of certain experiment stations, have aggressively fostered the mechanization of cotton growing until relatively recently. Research funds for this purpose were rather limited until after 1947.

In some instances, notably in population policy during the thirties, governmental action has tended to run counter to the trends associated with economic growth. Price support policy has had mixed effects. In one aspect it has provided low-cost producers with additional income which might be used to buy machinery; in another it has barely allowed high-cost producers who might otherwise have been forced out of commercial farming to remain in production. In general, and with notable exceptions, government agricultural policy in the cotton region has tended to be concerned primarily with objectives other than those of economic development.

Technological Factors

Although partial mechanization has been filtering into the Cotton Belt over a number of years, the technological problems involved in making total mechanization feasible were not easily solved. Two circumstances have distinguished cotton from other crops in this regard:

The technical complexity of total mechanization.—The conditions of cotton production are not nearly so standardized—especially at the harvest stage—as those of other major crops. This is largely the result of the wide variation in conditions under which cotton is grown, and has contributed greatly to the difficulty of designing satisfactory harvesting equipment. Because of the low-cost hand labor against which it had to compete, a mechanical cotton harvester had not merely to be moderately efficient but *highly* efficient in terms of quality of performance and labor-cost savings, or it would stand little chance of serious consideration by potential users. Hence some of the promising early inventions hardly received a trial.

Furthermore, the secondary labor requirement in the crop has been so important as virtually to nullify the economic significance of me-

chanical harvesting unless the weed problem could also be brought under control. Thus the successful mechanization of cotton has required a complement of new inventions and techniques, rather than a single strategic innovation.

Limited possibilities for borrowing.—In developing this complement of new devices, inventors and engineers have had little assistance in the way of earlier principles which could be borrowed and adapted or modified. Most of the significant recent innovations in cotton production (with the exception of the application of tractor power itself) are genuinely new, while in the mechanization of other major crops there has usually been a stream or continuum of basic inventions to draw upon and augment.

Factors Exogenous to Cotton Production

A number of influences originating outside the cotton economy have contributed over a period of time to a widely held belief that cotton growing was a declining industry, or at least one with a very uncertain future.

Competition from foreign and domestic substitutes.—The gradual decline of the export market for American cotton became apparent during the twenties and has remained a problem in most succeeding years except when the government took a major part in bolstering the market. The increase in foreign growths, which was encouraged by the American crop restriction program during the thirties, was the major reason for the decline in exports. In addition, the growing use of synthetic fibers abroad began to reduce the foreign demand for cotton. Somewhat more recently the domestic market has also been affected by the growing availability of synthetics. Rayon has especially benefited from relative price movements which have favored its substitution for cotton. Paper has likewise become an important competitor of cotton, particularly in industrial uses.

The population backflow during the great depression.—The interruption in the normal outflow of population from the eastern cotton areas during the depression and the return migration of persons seeking subsistence homesteads aggravated the problem of an already redundant labor force and prolonged the process of economic recovery in the South. By the end of the century the cotton region had in effect come to depend on the sustained capacity of the more dynamic sectors of the economy to absorb its excess population, and economic

depression outside the region, even though temporary, tended to produce lingering distress in the South.

Unstabilizing market effects of industrial depression and wars.—The consumption rates of American cotton in foreign and domestic markets have been subject to pronounced fluctuations since about 1910. The two major wars during this period resulted in serious curtailments of exports to established markets, and the general depression of the thirties reduced both foreign and domestic demand. Events of such magnitude as these resulted at various times in violent price fluctuations which severely affected farm incomes and rendered producers' decisions within the enterprise subject to a high degree of uncertainty from year to year.

The Combined Effect on "Entrepreneurial Drive"

The combined influence of institutional and technical obstacles to innovation, together with uncertainties about the future of the cotton enterprise induced by outside factors, no doubt tended to have a depressive effect on "entrepreneurial drive," or the promotional spirit of those who might hope to profit by innovation. Cases of individuals with unusual persistence and a high degree of ingenuity, such as Campbell, Appleby, Stuckenberg, and the Rust brothers, have been cited to show that courage and enthusiasm in the face of repeated failure were not lacking, but that the combined weight of technical and economic difficulties was usually overwhelming.

WHY ACCELERATED CHANGE HAS BEGUN

We now turn to the second major question raised by the study. How are we to account for the introduction and growing adoption, principally within the past decade, of methods for the complete mechanization of cotton production? Again we must review briefly the technological, institutional, and exogenous aspects of these recent developments.

The Simultaneous Fruition of Inventive Effort

The striking concurrence of technological achievements, representing the climax of years of inventive and promotional effort along a considerable variety of lines, is the chief reason for the increasing spread of mechanization in this crop. It is perhaps self-evident that the

machines and techniques had to be available in a practicable form before they could be adopted. Two aspects of this development should, however, not be overlooked: (1) The economic success of mechanical harvesting has depended on the simultaneous availability of a number of other significant innovations: methods of weed control, defoliation, and improved ginning, all of which, together with some other minor innovations, have only lately made their advent. (2) Both the means of mechanical harvesting and of weed control which are now available, or imminent, are so highly labor-saving as to promise to overcome the chief economic barrier which had long stood in the way of cotton mechanization: the availability of cheap hand labor. Short of a general depression such as that of the thirties and a return to very low wage levels, it is likely that the economic advantage will continue to lie with mechanization and that it will therefore continue to be an important "push" factor in future population movements. In other words, the complex of methods now at hand is meeting for the first time the requirement that it be *highly* efficient and *very* laborsaving.

Significance of Newer Cotton Areas

When one surveys the Cotton Belt one observes that the most rapid rates of introduction of mechanization are occurring in the newer areas of the Far West and Southwest. These are in general more productive areas than most of the older cotton region, and they are less subject to the weed problem. However, more significance probably attaches to the fact that as younger areas they have escaped the encrustation of institutions which has inhibited change elsewhere.¹ Since sharecropping never became established here, there have not been the problems of excessive resident population, small farm units, and neglected land associated with this system in the Old South. There are other, less tangible, indications that farmers have not been as tradition bound in their attitude toward newer methods of farming. Part of the explanation no doubt lies in the circumstance that, having more resources, farm operators in the western part of the belt had larger cash incomes and therefore greater flexibility in trying new methods. But the fact remains that in the older cotton areas even the larger, well-

1. For another historical illustration and a general explanation of the influence of a frontier movement in dislodging institutional controls see C. E. Ayres, *The Theory of Economic Progress* (Chapel Hill: The University of North Carolina Press, 1944), 132-37.

financed operators on good land did not as a group show the same aggressiveness in promoting mechanization that was already evident in the west before the war, and it has only been more recently that their attitudes seem to have been changing.

The "Shaking Up" Effect of World War II

World War II undoubtedly contributed to the acceleration of cotton mechanization, but there is little evidence that it did so by creating an acute shortage of farm labor and thus making way for the substitution of labor-saving machines. There were a few areas where this happened, notably in the High Plains, but in the region as a whole there was a greater tendency on the part of farmers to reduce their cotton acreage or abandon the crop altogether during the latter war years than to attempt to mechanize the stages of the crop representing the chief labor bottlenecks. Many of the technical refinements that were later to make total mechanization practicable were hardly ready by this time.

The more significant aspect of the war seems to have been that it severely "shook up" the cotton economy, causing farmers and their representatives to re-examine their customary practices, as well as the long-run prospects of the enterprise. The large movements of population during the period and the chronic fear of a prospective labor shortage led many farmers to consider earnestly the desirability of launching alternative enterprises, which a good many did. Partial mechanization on cotton farms, particularly the accelerated introduction of tractors into the Southeast, was largely the result of increased incomes which enabled farmers to begin to buy power equipment. This did little to relieve the crucial labor requirements, but has been important in paving the way for total mechanization on the larger farms in the future. Some of the operators of these farms have begun to work out transitional tenure arrangements in anticipation of the time when total mechanization will become economically preferable to present methods.

The anxiety about the future of the cotton enterprise toward the end of the war also led to the sponsorship of a vigorous beltwide research program under the Research and Marketing Act which may have an influence in facilitating the process of mechanization.

The unexpectedly high consumption rates for American cotton after the war, in part due to high levels of consumer demand in the United

States and foreign aid programs abroad, have encouraged a degree of optimism in the cotton region and provided incomes with which farmers are continuing to buy the equipment and supplies necessary to achieve more advanced stages of partial or complete mechanization. Implement manufacturers, chemical companies, and other private interests have begun to respond aggressively to this market, and we may expect to see the influence of sales promotion make its contribution to the mechanization process.

THE ECONOMIC IMPLICATIONS FOR THE COTTON ENTERPRISE

Although prediction is hazardous and it is far from the writer's intention to suggest that southern agriculture is going to be transformed overnight into a fully mechanized economy, certain tendencies seem to be inherent in the nature of the process now under way. These will be treated in two groupings: the economic implications for cotton growing as an enterprise, and the social implications for the southern rural economy.

The Irreversibility of the Process

As the discussion at the conclusion of Chapter 11 indicates, there is strong ground for believing that once the mechanization process gets under way it is unlikely to be reversed. This conclusion is drawn to a large degree from the observation of other enterprises, including other farm enterprises during the depression. But it is also based on a specific examination of what happens to cotton farms when the transition to mechanization begins. Operators who make this change tend to enlarge and consolidate their holdings, often replanning their farm layouts, removing tenant houses, and selling workstock to such an extent that it would be very difficult to go back to a former arrangement. Moreover, they make purchases of machinery and equipment which often represent substantial capital commitments. Psychologically they take a step which they believe to be progressive, and which would be extremely painful to retrace.

The significance of this conclusion lies largely in the field of public policy. In the event of another general depression it would be futile to expect the cotton economy to reabsorb displaced farm workers by

a resumption of labor-intensive methods of production, even though labor costs should drop considerably.

Increased Managerial Requirements for Efficient Farming

From the description in Chapter 7 of the precision techniques being introduced into cotton growing as correlatives of mechanical harvesting, it should be clear that the managerial function is assuming new importance and that its requirements are becoming highly technical. Indeed, one of the owners of a highly mechanized Mississippi plantation is reported to have remarked recently that he considered the shortage of skilled managers to be the next major bottleneck in the mechanization process. While this deficiency will no doubt be remedied in one way or another, the increasing skill demanded of cotton farmers contributes to the severity of the competitive trend under way.

Widening Disparity in Production Methods

Under the prevailing distribution of resources within the cotton economy the trend toward increasing mechanization can only lead to wider disparities than already exist in the methods, and therewith the costs, of cotton growing. There will be a very substantial group of farmers who because of the size of their holdings and similar resource limitations will not be able to participate in the mechanization process for some time to come, and another considerable group who will not be able to make the transition at all. This will intensify a problem that has long been present in the region—the wide differences in the incomes of farm families and the large number of very low incomes which are in part attributable to the severe internal competition between marginal producers and their economically more successful fellows. Since the advent of price support programs this condition raises particularly troublesome questions for public policy.

The announced object of applying the parity price formula was to relieve the disparity between farm and nonfarm incomes, and this it may tend to do for farmers as a whole. As the program operates in years when price supports become effective, however, the Government makes relatively small contributions to the incomes of the numerous marginal producers who form the lowest income group but who are thus encouraged to continue raising cotton by the relatively

inefficient methods available to them because it is the only way to qualify for an income supplement. At the same time the price subsidy adds significant amounts to the incomes of producers whose costs are substantially below market prices, and who are therefore least likely to need income relief.

Moreover, although it is linked to an acreage restriction program, the price support program places an incentive on increased output by relating the benefit to the number of pounds of cotton produced. The program thus embraces, in intermingled form, contradictory efforts to redistribute income and to control output. As mechanization widens the cost differentials within the enterprise there is likely to be an increase in the windfall gains to low-cost producers, but little income relief or assistance toward alternative adjustments for farmers who cannot mechanize. The fundamental dilemma in the price support program thus becomes: At what level is the government to set price guarantees in order to insure adequate farm incomes without at the same time unduly aggravating the inefficient utilization of resources, the accumulation of unmarketable surpluses, and the worsening competitive position of cotton?

Price Policy and the Competitive Position of Cotton

Careful studies of the responsiveness of various markets to changes in the price of cotton over fairly long periods of time indicate that the aggregate demand for cotton, unlike that usually associated with staple agricultural commodities, is elastic.² This is particularly true within the range of prices at which cotton has been selling in recent years, and is attributable to the increasing possibility for substitution of foreign-grown cotton and of synthetics when American cotton is priced relatively high. In the domestic market as a whole the substitution effect has not been strikingly evident because final consumption uses, such as clothing, have in the aggregate formed the bulk of the market, and the cost of raw cotton as a percentage of the cost of the typical retail product is rather small. Therefore a change in the price of cotton tends to have little effect on the cost of the product to the consumer

2. See the discriminating analysis and summary of other studies contained in M. K. Horne, Jr., "Cotton Price Policy in Relation to the Domestic Market," *Journal of Farm Economics*, XXXII, No. 4, Part 2 (November, 1950), 738-51. See also M. K. Horne, Jr., Frank A. McCord, and George Townsend, *Price and the Future of U.S. Cotton* (Memphis: National Cotton Council of America, 1955).

and his consequent demand for it. In industrial consumption, as we have seen in the case of automobile tires, the situation is different. The demand for cotton in those industrial uses where substitution is possible is highly sensitive to relative price changes as between cotton and its close competitors. The foreign demand for American cotton as compared with other growths and synthetics is also rather responsive to price changes, although this situation is vastly complicated by American lending policies and export subsidies, by foreign import restrictions and rayon producing capacity, and by quality considerations.

The mechanization of cotton production in the United States should have the effect of lowering the relative cost of growing the product, and if it becomes general, should permit on economic grounds alone a reduction in government price supports. There are those who argue that the cost reductions will be substantial enough to permit the enterprise to stand upon its own feet, and that the support program should therefore be dropped entirely, so that cotton may have its maximum competitive effect in recapturing markets taken by substitutes. The basic position of this group is that only under free market conditions will the efficient utilization of resources, and the adjustments necessary to that end, be assured.

A price policy advocated by another group would be based on the "price requirements of the market," or what critics have called "charging what the traffic will bear." The proponents of this policy recognize that at recent support levels cotton has tended to "price itself out of the market," and that it would not be in the long-range interests of the enterprise to underwrite by public action the very high prices which the market has sometimes supported in years of acute fiber scarcity. Nevertheless, this group believes that to withdraw price supports entirely would be to subject cotton producers once more to the uncertainties of extreme price instability and to the possibility of an unwarranted decline in gross income. These anticipations are based on two circumstances: (1) the differing degrees of competition characterizing farm and nonfarm industry, and (2) the inelasticity of domestic demand for raw cotton at relatively low prices.

The first circumstance has long been used to justify the concept of price parity as a goal for American agriculture in general. Manufacturing industry as a whole is held to have achieved a degree of imperfect competition which permits price rigidity and the restriction of output. Farming, on the other hand, remains highly competitive, and farmers

are unable by voluntary action to control their collective output. Prices of farm products consequently fluctuate more violently and have a chronic tendency to depreciate relative to those of nonfarm products. Some form of farm price support is thus held to be necessary as a form of insurance against price uncertainty and disparately low incomes.

The second argument for moderate price supports, based on the inelasticity of domestic demand, represents something of a paradox when compared with the assertion above that the aggregate long run demand for cotton at high prices is elastic. The qualifying phrases are important. If the export market for cotton is excluded (and most of the discussion of domestic price policy assumes that export price policy will be determined on a different basis) the domestic market that remains is dominated in volume by the apparel and household uses of cotton. These uses are characterized by decided inelasticity of demand, especially in the range of moderate to low cotton prices. One rough estimate suggests that producers might expect a loss of about 40 per cent in gross income if the price of cotton were to be allowed to fall to free market levels as opposed to "moderately good" (but not high) supported prices.³ The proponents of moderate price supports believe that it would be possible to avoid this loss of income without risking further substitution in the basic market by setting price guarantees so that they would not exceed "the price requirements of the market" (actually only the final consumption portion of the domestic market).

Both those who argue for the abandonment of price supports and those who advocate the transition to a policy of only moderate supports appear to minimize the two principal factors that seem to have generated the political pressures for increasingly high price guarantees. One of these is the tendency for many producers to take a strictly short-run view of the enterprise and to consider only the possibility of maximizing *this* year's income by whatever means that will influence *this* year's prices—regardless of the cost and market trends that are creating profound secular effects. For this attitude there is presumably little remedy but more widespread information and discussion, as well as counter political pressures from other interests.

The second factor is closely related and has been mentioned several times before. The large number of marginal producers, who col-

3. The estimate is illustrative only, and subject to many qualifications. See Horne, "Cotton Price Policy in Relation to the Domestic Market," 744-45.

lectively exercise a political influence that is undoubtedly significant, have a direct stake in high price supports which may amount in their minds to economic survival. Since this group will not only receive little benefit but on the contrary will probably experience intensified competition from increased mechanization, they may become increasingly dependent on income supplements made possible by government action, unless they find suitable alternatives.

It appears to the writer that no satisfactory solution to the price support dilemma will be found until the problem is recognized to have two distinguishable aspects for which separate policies, each with its own objectives, need to be developed. The first of these objectives is the rationalization of southern agriculture, so that it need no longer remain a labor exploitative industry. The technological process by which this can be accomplished is now under way, and it could be fostered and guided (though not arrested) by a comprehensive program of research, education, credit assistance, and related policies, among which price supports should become decreasingly important.

The other objective, which requires equal recognition on social welfare grounds, is the reduction in the concentration of low incomes in the South which is part of the heritage of a long period of retarded economic development. This problem extends beyond the cotton enterprise and should not be identified with it to such a degree that price supports remain the chief corrective instrument. Detailed proposals for the solution of the problem are beyond the scope of this study; appropriate measures might well include a more effective application of the Social Security program to the farm population, a regional land use adjustment program, and an aggressive approach to the promotion of alternative employment opportunities.

The Effect on the Size of Farm Units

Because the trend is so clear in other crop regions which have undergone mechanization, it has frequently been forecast that cotton mechanization will inevitably lead to farm units of much greater size. It has been feared by some that the "family-sized farm" or moderate-sized unit would be crowded out by the "factory farm" or very large scale unit. Can the moderate-sized unit be preserved?

While it is true that at the present time the most advanced forms of mechanization are associated with large scale units, it is too early to predict with assurance the effect of mechanization on the characteristic

type of farm. Units will no doubt tend to grow larger, on the average, but this will not necessarily mean the decline of the family-operated farm. Much will depend upon the direction which mechanization takes. In the High Plains we have noted that the cotton stripper has so far aided in the preservation of the single-family unit by relieving the operator's dependence on an uncertain seasonal labor supply at an investment cost that was within the reach of this type of farmer.⁴ If the use of one form or another of the stripper becomes feasible in other areas such as the Southeast, it may fill a need such as that met by the small combine in other crops. It will, however, have to be supplemented by advances in methods of weed control which are also adapted to this type of operation.

Where the spindle picker is used it tends to dictate larger units because of its size as an investment and because of its capacity when put to efficient use. Yet the machine may be used on a custom basis by farmers who could not afford to own one. In California where the spindle picker has been used most extensively it is apparently possible for both very large scale units, over ten thousand acres, and moderate-sized units, as small as eighty acres, to operate profitably under nearly equal degrees of mechanization.⁵ The smaller units seem to possess advantages of managerial and supervisory efficiency which enable them to survive and prosper under highly competitive conditions. In areas irrigated with surface water, public policy with respect to water rights also plays a large part in determining the characteristic size of unit.

The Necessity for Continued Land-use Adjustments

As mechanization proceeds in the South it will become increasingly apparent that certain areas are unsuited to cotton production to such a degree that they ought to be withdrawn from this use and if possible converted to other, more economic, uses. If accomplished on a sufficiently extensive scale, such a conversion of land utilization might contribute to the solution of the dilemma inherent in the present price

4. "Moderate-sized" units in the High Plains are of course considerably larger than those so characterized in the Southeast. It should also be noted that in the more mechanized crop regions of the United States the concept "family-sized farm" is a flexible one and has tended over the years to embrace an increasing number of acres.

5. Some of the California units are extremely large. For a description of an 86,000-acre operation and the unusual access to credit enjoyed by its management see "California's Cotton Rush," *Fortune*, XXXIX (May, 1949), 130-34.

support program by reducing the number of marginal cotton farms. An appropriate revision of existing credit regulations would perhaps assist this process. However, it would be unreasonable to expect in most instances that the farmers affected would be able to take the initiative or command the resources to make the desired shifts. A concerted program for the relocation of displaced population as well as for the desired changes in land use would be entailed. Since such a program is at present a political improbability, the adjustments which are made will no doubt follow the usual haphazard course.

THE SOCIAL IMPLICATIONS FOR THE COTTON ECONOMY

In addition to the direct economic effects on the cotton enterprise already mentioned several broader social consequences of mechanization may be anticipated. Only the most obvious consequences will be discussed here; yet it must be observed that the effects of technological revolution are often subtle and unexpected, and until we can observe the course of events these conclusions must remain tentative.

Continued Pressure on Farm Population

This hardly needs reiteration. Whatever the "pull" forces may prove to be as the result of developments outside the economy, the introduction of highly labor-saving methods into southern agriculture will exert an inexorable "push" on farm population. One cannot predict how great the resulting population displacement will be, but the transitional tenure arrangements which have been described indicate that it is already under way in areas where partial mechanization had previously had little displacement effect. Happily the means of population mobility in this country are great and the avenues of escape numerous. It will be fortunate if the transition to a rather fully mechanized agriculture in the South can be completed while the current process of industrialization and urbanization within the region is in full momentum.

Rise in the Rural Standard of Living

It is sometimes held that because the progress of agriculture seems to depend on a sloughing off of population, farming must remain a relatively unattractive pursuit. Otherwise there is a danger that the requisite population outflow will be retarded or reversed. From this the inference is readily drawn that the continuation of a lower stand-

ard of living on the farm, if not general rural poverty itself, is an economically necessary part of the process of economic development. Paradoxically, this forbidding prospect for farming as an occupation is a concomitant of the increasing productivity of agriculture itself, and is most likely to be evident when farmers are making rapid strides in improving their productive efficiency. This point of view has been most cogently presented by Professor Boulding in the following passage:

The degree to which agricultural policy has been dominated by the idea of "justice" to a depressed industry makes of peculiar importance the question why agriculture is thus depressed. Economic analysis throws a good deal of light on this historical phenomenon. The explanation rests on two propositions. The first is that as the products of agriculture are for the most part basic necessities, "means of subsistence," with very inelastic demands, an improvement in agricultural techniques results only in a limited increase in agricultural output, and manifests itself mainly in a transfer of resources, especially of labour and capital, out of agriculture into other occupations. Hence in a technically progressive society, and especially in a society in which agricultural techniques are improving, the proportion of total resources devoted to agriculture continually falls. The past two hundred years have seen a most striking demonstration of this great interpretative principle.

The second proposition is that in order for resources to be transferred from one occupation to another, the relatively declining occupation must be less attractive than the relatively expanding one. No matter what form of society we have, this relative unattractiveness of a declining industry is achieved through the system of relative prices; the "terms of trade" of the declining industry, i.e. the ratio of what it gets for what it gives, must be such as to make the resources employed in it look longingly at the other side of the fence.⁶

As applied to the current developments in the cotton economy does this mean that cotton growers can expect to derive no benefits from their improved techniques, but must see the advantage go to processors and consumers? Even assuming the absence of the market interferences which Professor Boulding protests, it seems unlikely that this would be the case. Departures from the farm population there must

6. Kenneth E. Boulding, "Economic Analysis and Agricultural Policy," *Canadian Journal of Economics and Political Science*, XIII, No. 3 (August, 1947), 440.

be, as has been shown, and some of the resulting dislocations will no doubt be painful. But it seems unreasonable to believe that the mechanization of cotton growing will not materially raise the standard of living of the population remaining on the farms. *Relatively* the standard may remain low, but *absolutely* it should increase. This seems but a logical consequence of the transformation of cotton farming from a labor-intensive enterprise to one in which manpower is more advantageously combined with other resources.

Moreover, if experience in other rural areas is any guide, the changed methods of farming will generate increased opportunities for local service occupations in rural communities. The new balance of population distribution will permit greater agricultural diversification to meet developing local market conditions, and will widen the possibilities for seasonal and full-time occupational alternatives.

It should perhaps be added that all of these developments are highly dependent upon the continuation of high levels of employment in the national economy as a whole, since a mere reshuffling of occupations within rural communities would not insure the necessary jobs and markets for the population involved.

Alleviation of Long-standing Social Problems

Among the most interesting aspects of the changes in southern agriculture are the decreased dependence on the use of child labor and the eventual reduction in interracial tensions long present in the South. One may easily overrate the importance of a single factor in its effect upon a social attitude so widely held and emotionally rooted as racial discrimination. Yet there is no doubt that the peculiar relation of southern Negroes to cotton as a cheap-labor crop has long fostered the more coercive forms of racial exploitation in the region. A redistribution of population and a general increase in the standard of living should ease the economic competition which intensifies group hostility. While recent events have shown that these changes can be very disturbing at the outset, the longer run effects are certain to be beneficial.

Mechanization of cotton production has already begun to have its effect on the reduced need for child labor and the consequent extension of educational opportunities to children, both white and Negro, who formerly had to spend much of the school year chopping and picking cotton. A pioneer study on this subject was conducted in 1950

by Lewis W. Jones and B. F. MacLaurin in Coahoma County, Mississippi, one of the most mechanized of the Delta counties.⁷ From 1940 to 1950 the number of tractors in this county is estimated to have increased five times, from 487 to 2,500. Mechanical cotton pickers, introduced in 1943, numbered two hundred by the end of the decade.

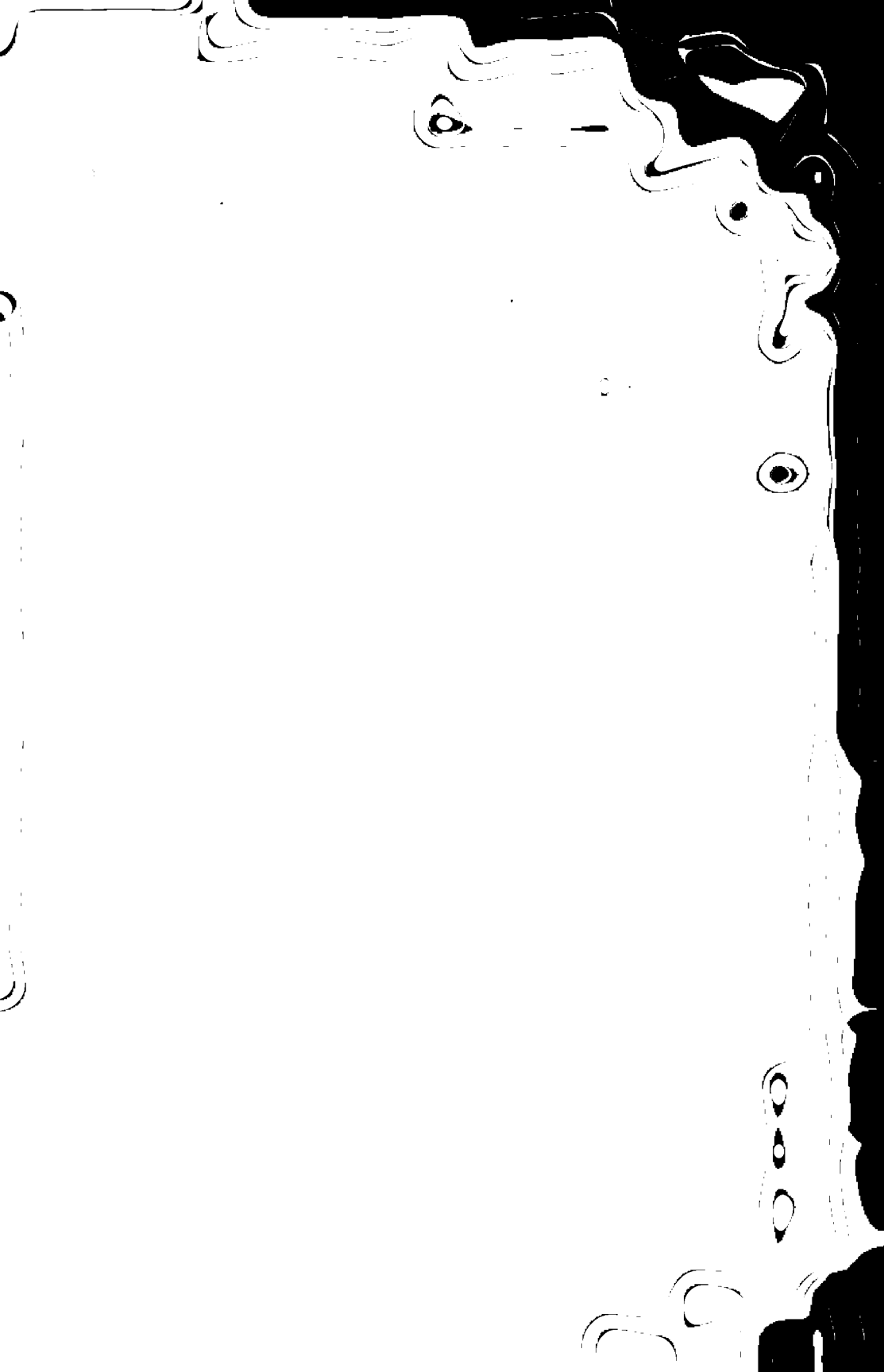
An examination of school census data for the years 1929-30 and 1948-49 showed that although the school-age population in the county changed very little between these dates, farm families with children moved to Clarksdale, the chief urban center, in considerable numbers during the period. As a consequence, there was a marked increase in enrollment and attendance in the urban schools. Negro children, who were six times as numerous as white children in the county, increased their average daily attendance by 41 per cent in the urban schools during this period, and for the first time began to appear in grades above the eighth. Only a few years before most of these children were required to pick cotton from September through November and the teen-age boys spent the spring months plowing and cultivating. A change in the community attitude was reflected in the fact that beginning about 1950 the law against employment of children under sixteen years of age in the cotton fields was for the first time being enforced by local police.

These changes are not attributable solely to farm mechanization, of course—increased opportunities for employment in the towns and cities have played their part—but the evidence is compelling that it is having a profound effect. If one takes the long view, it is probable that the changed economic significance of children in farm families will also influence a change in the characteristic fertility pattern. Children on the farm under the old method of farming were an economic asset. At an early age they began, in however small a way, to contribute to the family income. In the city they are an economic liability to their families and, if not provided with something to occupy their energies, a possible delinquency problem to the community. Thus we may expect the characteristically high rural birth rate to drop after parents become aware of the changed requirements of urban life (as it generally has in similar cases). And we may expect that southern communities will increasingly recognize the desirability of affording

7. Lewis W. Jones and B. F. MacLaurin, "Machines in the Cotton Fields: Children in School," *School and Society*, LXXIV, No. 1920 (October 6, 1951), 217-19.

full educational opportunities to the Negro children who are no longer needed as unskilled workers on the farm.

The issue of racial integration in the schools resulting from the recent Supreme Court decision thus arises at a critical time, when southern towns and cities are having to provide increased school facilities both as a result of the process just described and the general increase in birth rates. However, once the adjustment is made, the South will find itself with a better educated, more productive population, and one that is better distributed with respect to its economic resources and occupational opportunities. While these changes will not come easily or all at once, they will in time alleviate many of the problems that have for generations characterized the South as an "underdeveloped area." This is the dramatic social impact of the new revolution in the cotton economy.



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